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# (54) AN AIR BALANCING AND AERATION SYSTEM COMPRISING A DIFFUSER

(57) The present invention relates to a system for air balancing and aeration of a room (400), comprising a range hood (200) having a blowing fan for extracting air and creating a negative pressure in the room (400), and a diffuser (100) having an aperture (111) for airflow and an electrical motor (123) for controlling airflow through said aperture (111). The range hood (200) comprises a transmitter generating a wireless signal upon activation thereof, and said diffuser (100) comprises a receiver for receiving said wireless signal and a controller for actuation of the electrical motor (123) automatically based on said wireless signal for controlling the airflow through the aperture (111).

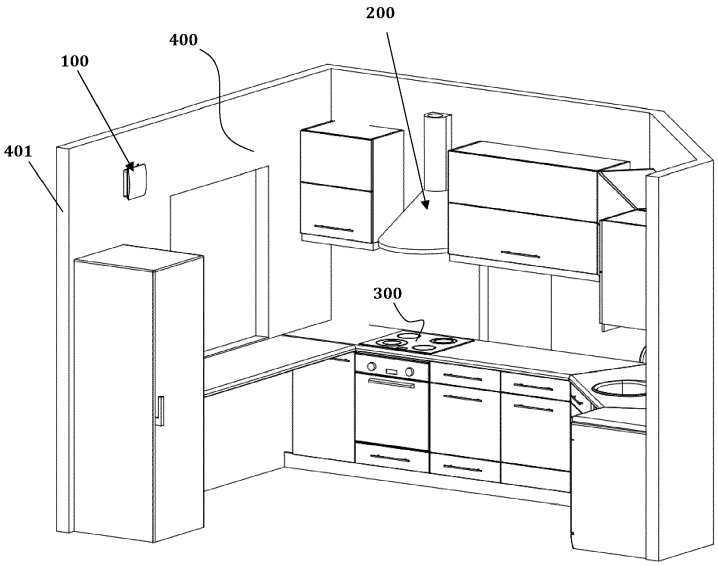


**Figure 7**

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## Description

### Technical Field

**[0001]** The present invention relates to an air balancing and aeration system for use in a room. More particularly, the present invention pertains to a system comprising a diffuser which works in wireless communication with a cooking appliance and various sensors for balancing air pressure and supplying fresh air whenever required without interference of the user.

### Background of the Invention

**[0002]** It is known that an intense smell occurs during cooking in areas with limited air circulation. For children, patients and elderly people, intense smells, smoke and dirty air would be highly harmful and annoying. Central ventilation systems are used in multi-unit residential buildings for intake and exhaust of air in kitchens, rooms, bathrooms, or any other area of the apartments. Central exhaust systems or discharge lines are already used in Europe particularly in Nordic countries for discharging dirty air from the buildings.

**[0003]** Range hoods or windows are used to clean indoor air environment The air extraction of the hood during cooking is especially important for the quality of air. A common exhaust line may be connected to the kitchen appliances such as range hoods for extracting smoke on a cooktop. However, current systems do not contribute to air balance in the rooms (i.e. kitchens) where a cooking appliance such as range hood is operated which actually creates a negative pressure that needs to be balanced with a diffuser or an opening such as window. Fresh air is also needed in return of the negative pressure in order to improve quality of air in a particular room as mentioned above.

**[0004]** There are applications that include a high-power engine connected to a common exhaust line for sucking the internal dirty air of the apartments and discharging the same to the outside. CN 207122434 discloses a residential kitchen and bathroom exhaust duct system, in particular a negative pressure exhaust system. Its principle is that the range hood controls the start and stop of the roof fan through a pressure transmitter.

**[0005]** Similar devices are also provided in KR 2019/0028402, comprising integrated remote-control system for a ventilation apparatus in a public building. An object of this invention is to provide an integrated remote control system for a ventilation system in a public building that enables operation and maintenance of a constant air flow meter, a damper, and a BLDC motor of a roof fan through an active remote control. WO 99/47839 A1 discloses a flow control device for ducts which is operated based on the iris-diaphragm principle with control leaves. This arrangement is more convenient for ventilating a room; however, the system is complicated. The potentiometer used to provide a real time indication of the actual control position of the damper increases complexity of the overall design. Hence, the flow control device provided in this document has limited usability in a central ventilation system of a building.

**[0006]** Diffusers are generally used in closed areas for aeration purposes. Conventional diffusers are mounted on a wall of the room. They have an opening extending through the wall reaching to ambient air (open air out of the building) and another opening to inside of the room. Air flow from outside to inside of the room or vice versa is controlled by an inner valve of the diffuser. These diffusers however are operated manually, and air flow rate is adjusted by the user. The present invention makes use of the diffusers of above type in rooms (i.e. kitchens) where an air balance is needed due to the negative pressure created by air suction of a cooking appliance such as a range hood.

### Brief Description of the Invention

**[0007]** The present invention provides a system for air balancing and aeration of a room (400) having walls (401) as shown in Fig. 7 for solving the above-mentioned problems. The system comprises:

- a range hood (200) having a blowing fan for extracting air and creating a negative pressure in the room (400), and
- a diffuser (100) to be disposed on one of the walls (401), said diffuser (100) having an aperture (111) for airflow and an electrical motor (123) for controlling airflow through said aperture (111), wherein a front portion of the diffuser (100) is adapted to be exposed to inner environment of the room (400) and a rear portion thereof is adapted to be exposed to outer environment behind the wall (401)

characterized in that the range hood (200) comprises a transmitter generating a wireless signal upon activation thereof, and said diffuser (100) comprises a receiver for receiving said wireless signal and a controller for actuation of the electrical motor (123) automatically based on said wireless signal for controlling the airflow through the aperture (111).

**[0008]** The range hood (200) and diffuser (100) are connected to each other with a wireless communication protocol which can be Wi-Fi, infrared or Bluetooth.

**[0009]** The system according to the present invention advantageously incorporates a diffuser (100) comprising a valve (12) accommodating said electrical motor (123). The valve (12) may comprise a stationary disc (121) having at least an aperture (124) for airflow, and a damper (122) rotatably connected to the electrical motor (123). The damper (122) corresponds to said aperture (124) for partly or fully closing said aperture (124). A further advantage of the present system is that the electrical motor (123) can be a servo motor.

**[0010]** In preferred embodiments, the range hood

(200) is adapted to produce a signal proportional to the electrical current consumed by it and the servo motor is configured to rotate the damper (122) to a predetermined position corresponding to said signal. Alternatively, the range hood (200) can be adapted to produce a signal proportional to the speed of the blowing fan thereof and the servo motor is then configured to rotate the damper (122) to a predetermined position corresponding to said signal.

**[0011]** The system may also comprise an additional sensor having a transmitter connected to the diffuser (100) with a wireless communication, which sensor is to be disposed in a cooking appliance (300) such that once the cooking appliance (300) is activated, the sensor transmits a wireless signal to the diffuser (100) so that it can activate the electrical motor (123) and allow an airflow through the room (400).

**[0012]** In another embodiment, the system may comprise an additional sensor having a transmitter connected to the diffuser (100) with a wireless communication, which sensor is adapted to detect temperature, humidity, smoke, gas or odours, and generate a wireless signal when the smoke, gas or odour in the room (400) is above a predetermined level so that it can activate the electrical motor (123) and allow an airflow through the room (400). The additional sensor may also be of the type detecting pressure and generating a wireless signal when the pressure in the room (400) is below a predetermined level so that it can activate the electrical motor (123) and allow an airflow through the room (400).

**[0013]** In further aspects the present invention provides a method for installing the foregoing system into a room (400) as explained in greater detail in the following description.

## Brief Description of the Figures

**[0014]** The preferred embodiments of the present invention are illustrated via non-limiting drawings wherein;

Figures 1a and 1b show exploded view of the diffuser (100) according to the present invention from back and front perspective angles, respectively.

Figure 2 is a perspective view of the diffuser body (11) provided in the diffuser (100) according to the present invention.

Figure 3 is a planar view of the diffuser body (11) provided in the diffuser (100) according to the present invention.

Figures 4a and 4b show front and rear views of the front cap (14) provided in the diffuser (100) according to the present invention.

Figures 5a, 5b, 5c and 5d show different views of the valve (12) provided in the diffuser (100) according to the present invention.

Figures 6a and 6b show rear and front perspective views of the diffuser (100) in assembled form according to the present invention.

Figure 7 shows a representative view of a kitchen having the system according to the present invention.

## Detailed Description of the Invention

**[0015]** As shown in Fig. 1, the air balancing and aeration system of the present invention comprises basically a range hood (200) and a diffuser (100) adapted to be located on a wall (401) of a room (400) such as a kitchen. The diffuser (100) is provided in wireless communication with said range hood (200) in a way such that when the latter is activated, the diffuser (100) is automatically activated to allow airflow from external environment through the room (400).

**[0016]** More particularly, the diffuser (100) may communicate with the range hood (200) with a wireless communication protocol such as Wi-Fi, infrared or Bluetooth. For this purpose, the range hood (200) comprises a transmitter (not shown) which generate signals upon activation of the range hood (200) and said diffuser (100) comprises a receiver (not shown) for receiving said signals and controlling air flow from external environment through inner environment of the room (400).

**[0017]** In the context of the present invention, the expression "range hood" refers to a kitchen appliance used for extraction of vapor, smoke and dirty air by creating a negative pressure. It can be of the conventional type such as those hung over a cooktop or of the new generation type such as those integrated with the cooktop or worktop.

**[0018]** In the context of the present invention, the term "activation" used in conjunction with working status of a device refers to the general state of switch-on where electricity is supplied and consumed by the device for carrying out its function. For instance, activation of the range hood, refers to the general state where electricity is supplied and consumed by the range hood including the states when a fan motor starts to work and extract air from inner environment of the room.

**[0019]** Referring now to Figures 6a and 6b, the diffuser (100) according to the present invention is a compact device having front and rear sides whereby front side is disposed to the inner environment of the room (400) and the rear side is directed to the external environment of the room (400) at the outer side of the wall (401). As shown in Figures 1a and 1b with exploded views of the diffuser (100), it is basically designed to allow air passage from an external environment via an air opening (111). The diffuser (100) comprises a valve (12) as shown in Figures 5a to 5d which functions for opening and closing of the air flow through said opening (111). The diffuser

(100) mentioned above may further comprise a front cap (14) and a diffuser body (11) in order to accommodate the valve (12) therebetween. The diffuser body (11) as shown in greater detail in Figures 2 and 3 is disposed behind the wall (401) and exposed to external air, and may have said air opening (111). As shown in Figures 4a and 4b, the front cap (14) may have corresponding apertures (141) for air flow. A front cover (15) may also be provided for a more aesthetic appearance and preventing a rigorous airflow through the room (400). Said front cover (15) may be manufactured from a suitable material including plastics, glass or metal. The front cap (14) as shown in Figures 4a and 4b can be disposed between the valve (12) and said front cover (15).

**[0020]** The valve (12) provided in the diffuser (100) is advantageously designed to work in compliance with the system according to the present invention. For this purpose, the valve (12) comprises a stationary disc (121) having at least an aperture (124) for airflow and a damper (122) corresponding to said aperture (124) for partly or fully closing the aperture (124). As shown in Figures 5a to 5d, the diffuser (100) further comprises an electrical motor (123) moving said damper (122) over the stationary disc (121). The electrical motor (123) is preferably a servo motor. A servo motor is specifically known as a rotary actuator or motor that allows for a precise control in terms of angular position, acceleration and velocity capabilities that a regular motor does not have. Taking this advantage, the diffuser (100) according to the present invention can be adapted to open the airflow passageway, i.e. aperture (124) fully or partly depending on the signal received from the range hood (200). For instance, the range hood (200) can be adapted to produce an electrical signal proportional to the electrical current consumed by it and then the electrical motor (i.e. servo motor) receiving said signal may rotate the damper (122) to a predetermined position allowing a certain airflow through the room (400). Alternatively, the position of the damper (122) and thus airflow can be adjusted depending on the mode of operating the range hood (200) such that in each level of the fan speed thereof, a signal corresponding to the fan speed is transmitted to the diffuser (100) and damper is then moved to the position corresponding to said signal.

**[0021]** The diffuser (100) according to the present invention can be placed on a wall (401) of a room (400) by way of simply drilling said wall (401) and then providing electricity for activation of the electrical motor (123). For this purpose, the diffuser (100) comprises an electrical circuitry (13) which also includes a receiver, and a controller (16) for generating control signals based on the signals transmitted by the range hood (200) for activating the motor (123). Optionally, said controller (16) may include an on/off switch (not shown) for manually operating the electrical motor (123). A light indicator may also be provided in order to show on/off state of the diffuser (100). Electrical connection of the diffuser (100) may be provided by a number of inputs (112) which may be provided anywhere such as the diffuser body (11).

**[0022]** In another embodiment of the present invention, the diffuser (100) may further comprise a blowing fan and a motor (not shown) which forces airflow through inside of the room (400). Due to the valve (12) provided in the diffuser (100), the system is kept close to airflow in an inactive state of the diffuser (100) and therefore undesired airflow into the room (400) is prevented. Preferably, the motor mentioned above is adapted to operate when valve (12) is activated and its aperture (124) is in an open state.

**[0023]** In another aspect of the present invention, the diffuser (100) is adapted to work with additional sensors having transmitters (not shown). One of these additional sensors may be located in a cooking appliance (300) of the kitchen such as a cooktop or an oven, such that once the cooking appliance (300) is activated, the sensor transmits a signal to the diffuser (100) so that it can activate the electrical motor (123) and allow an airflow through the room (400). Likewise, the additional sensor may be of the type detecting temperature, humidity, smoke, gas or odours. It similarly produces a signal once the temperature, humidity, smoke, gas or odour in the room (400) is above a predetermined level, and transmits said signal to the diffuser (100) for aeration. The additional sensor may also be of the type detecting pressure and generating a wireless signal when the pressure in the room (400) is below a predetermined level so that it can activate the electrical motor (123) and allow an airflow through the room (400). These sensors are of the known type and will not be described in detail.

**[0024]** With the additional sensors mentioned above, the diffuser (100) may be activated even if the user ignores activation of the range hood (200) for a better aeration. They also ensure safety in a living area by detecting temperature, humidity, smoke, gas or odours and automatically activate the diffuser (100) for supplying fresh air. Therefore, the system of the present invention not only balances the air pressure in the room but also provides additional safety and comfort by supplying fresh air even if the user ignores to activate the range hood (200).

**[0025]** By use of the diffuser (100) simultaneously with the range hood (200), the problems encountered with the pressure drop caused by functionality of the range hood (200) are eliminated. Particularly, the pressure drop causing a decrease in flow capacity and increase in noise of the range hood (200) is presently overcome by the instant invention.

**[0026]** In a further aspect, the present invention provides a method for installing the system explained above comprising the steps of:

- mounting the range hood (200) around a cooking appliance (300) in the room (400),
- drilling a wall (401) of the room (400) and mounting the diffuser (100) in a way such that a front portion of the diffuser (100) is exposed to inner environment of the room (400) and a rear portion thereof is direct-

ed to outer environment behind the wall (401),

- providing a wireless communication between the range hood (200) and diffuser (100), and
- optionally mounting an additional sensor for detecting temperature, humidity, pressure, smoke, gas or odours in the room (400), and providing a wireless communication between the sensor and said diffuser (100)

**Claims**

**1.** A system for air balancing and aeration of a room (400) having walls (401), comprising

- a range hood (200) having a blowing fan for extracting air and creating a negative pressure in the room (400), and
- a diffuser (100) to be disposed on one of the walls (401), said diffuser (100) having an aperture (111) for airflow and an electrical motor (123) for controlling airflow through said aperture (111), wherein a front portion of the diffuser (100) is adapted to be exposed to inner environment of the room (400) and a rear portion thereof is to be directed to outer environment behind the wall (401),

**characterized in that** the range hood (200) comprises a transmitter generating a wireless signal upon activation thereof, and said diffuser (100) comprises a receiver for receiving said wireless signal and a controller for actuation of the electrical motor (123) automatically based on said wireless signal for controlling the airflow through the aperture (111).

**2.** A system according to claim 1 wherein the range hood (200) and diffuser (100) are connected to each other with a wireless communication protocol selected from the group consisting of Wi-Fi, infrared and Bluetooth.

**3.** A system according to claim 1 wherein the range hood (200) is of the type hung over a cooking appliance, or integrated with the cooktop or worktop.

**4.** A system according to claim 1 wherein the diffuser (100) further comprises a front cap (14) extending perpendicular to the direction of airflow.

**5.** A system according to claim 1 wherein the diffuser (100) comprises a valve (12) accommodating said electrical motor (123) wherein the valve (12) comprises a stationary disc (121) having at least an aperture (124) for airflow, and a damper (122) rotatably connected to the electrical motor (123) which damper (122) is corresponding to said aperture (124) for partly or fully closing said aperture (124).

**6.** A system according to any of the preceding claims wherein the electrical motor (123) is a servo motor.

**7.** A system according to claim 6 wherein the range hood (200) is adapted to produce a signal proportional to the electrical current consumed by it and the servo motor is configured to rotate the damper (122) to a predetermined position corresponding to said signal.

**8.** A system according to claim 6 wherein the range hood (200) is adapted to produce a signal proportional to the speed of the blowing fan and the servo motor is configured to rotate the damper (122) to a predetermined position corresponding to said signal.

**9.** A system according to claim 1 wherein the system comprises an additional sensor having a transmitter connected to the diffuser (100) with a wireless communication, which sensor is to be disposed in a cooking appliance (300) such that once the cooking appliance (300) is activated, the sensor transmits a wireless signal to the diffuser (100) so that it can activate the electrical motor (123) and allow an airflow through the room (400).

**10.** A system according to claim 1 wherein the system comprises an additional sensor having a transmitter connected to the diffuser (100) with a wireless communication, which sensor is adapted to detect temperature, humidity, smoke, gas or odours and generate a wireless signal when the temperature, humidity, smoke, gas or odour in the room (400) is above a predetermined level so that it can activate the electrical motor (123) and allow an airflow through the room (400).

**11.** A system according to claim 1 wherein the system comprises an additional sensor having a transmitter connected to the diffuser (100) with a wireless communication, which sensor is adapted to detect pressure and generate a wireless signal when the pressure in the room (400) is below a predetermined level so that it can activate the electrical motor (123) and allow an airflow through the room (400).

**12.** A system according to claim 9 wherein the cooking appliance (300) is a cooktop or an oven.

**13.** A method for installing a system according to any of the preceding claims into a room (400) comprising the steps of:

- mounting the range hood (200) around a cooking appliance (300) in the room (400),
- drilling a wall (401) of the room (400) and mounting the diffuser (100) in a way such that a front portion of the diffuser (100) is exposed to

inner environment of the room (400) and a rear portion thereof is directed to outer environment behind the wall (401),

- providing a wireless communication between the range hood (200) and diffuser (100), and
- optionally mounting an additional sensor for detecting pressure, smoke, gas or doors in the room (400), and providing a wireless communication between the sensor and said diffuser (100).

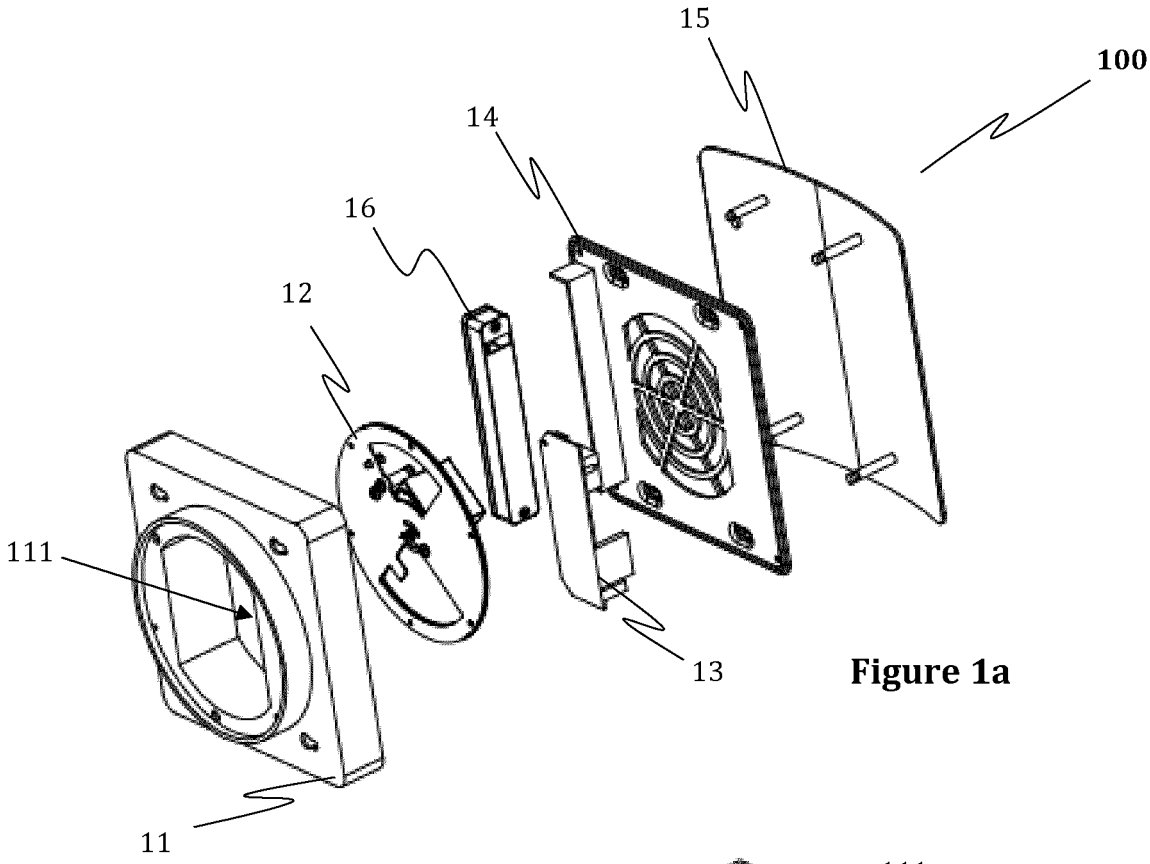


Figure 1a

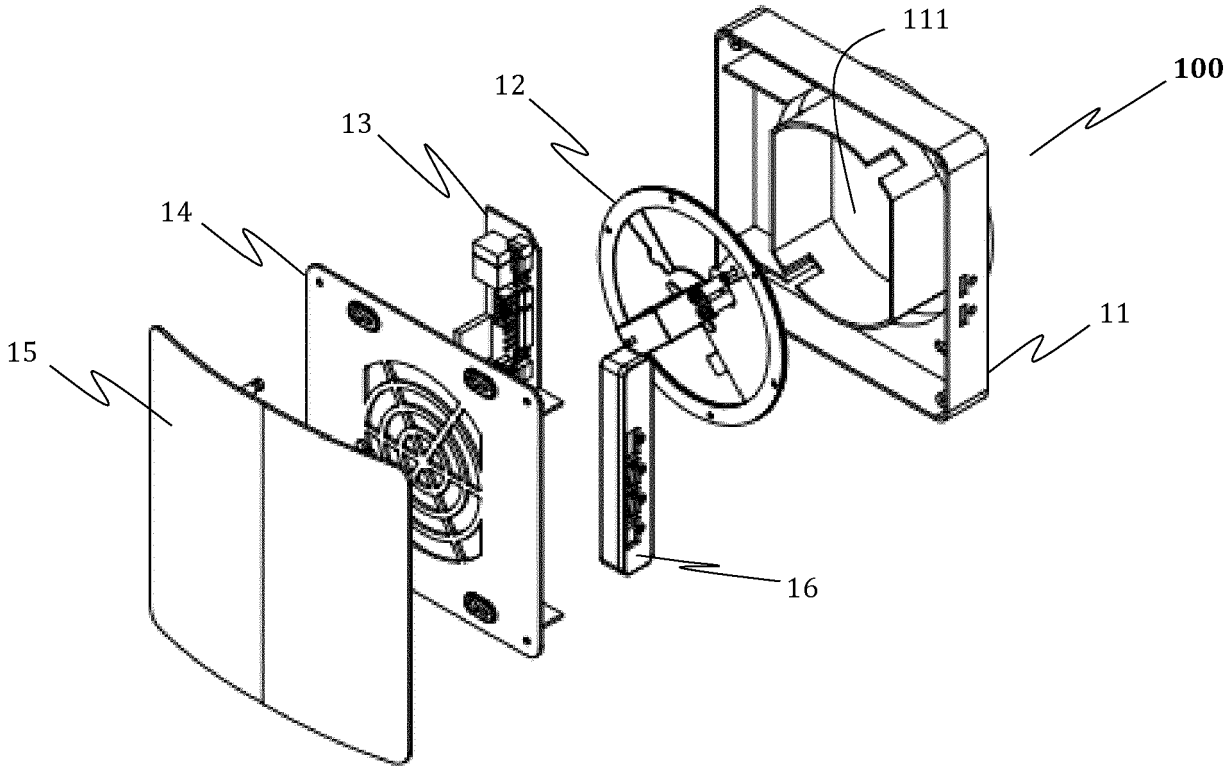


Figure 1b

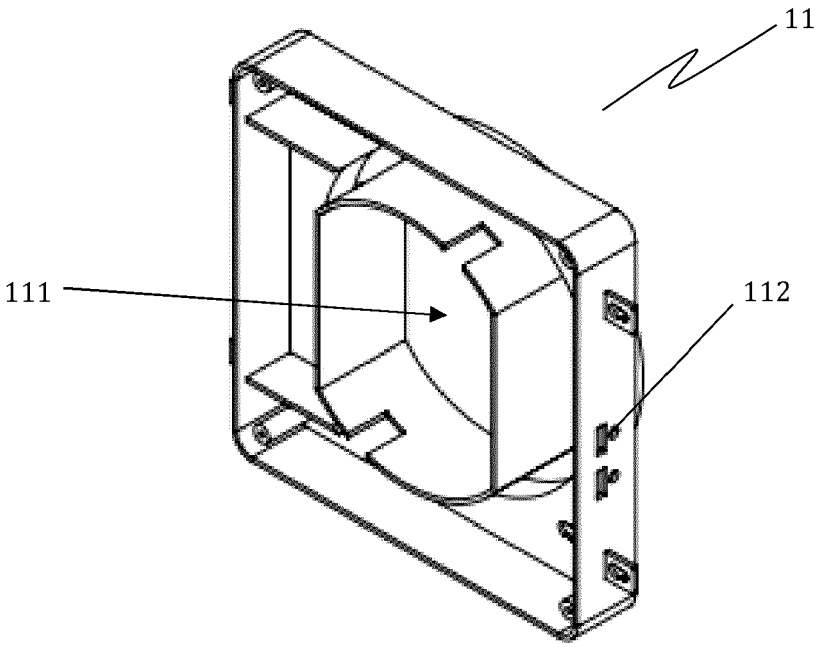


Figure 2

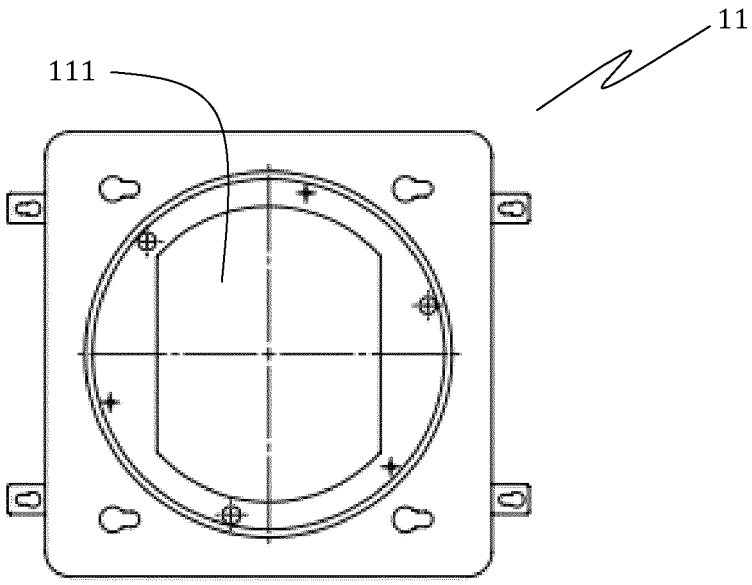


Figure 3

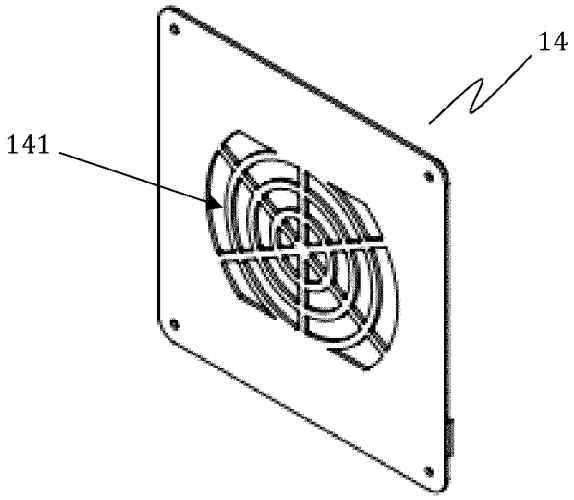


Figure 4a

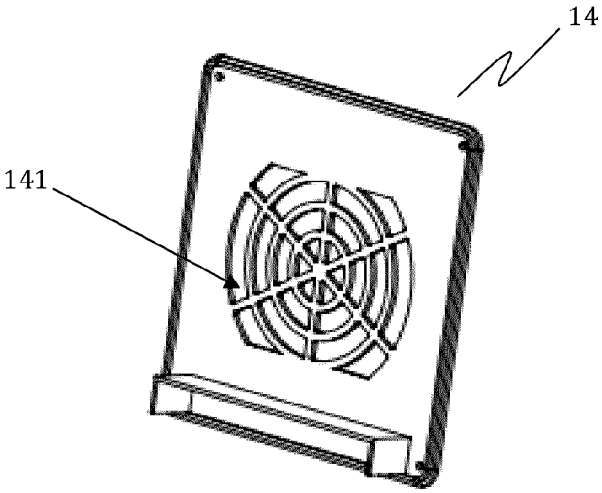


Figure 4b

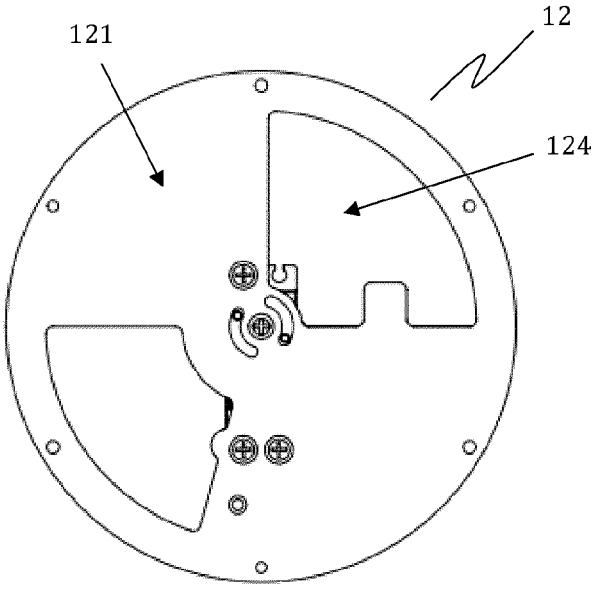


Figure 5a

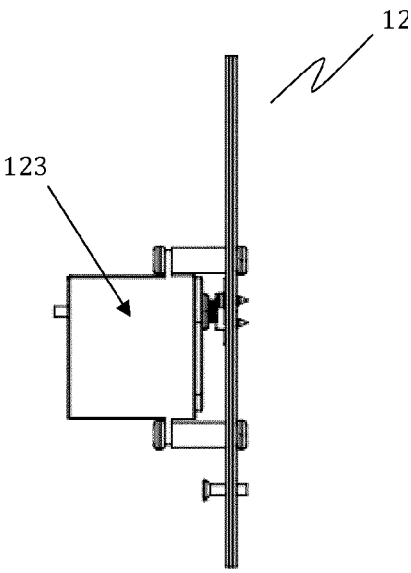


Figure 5b

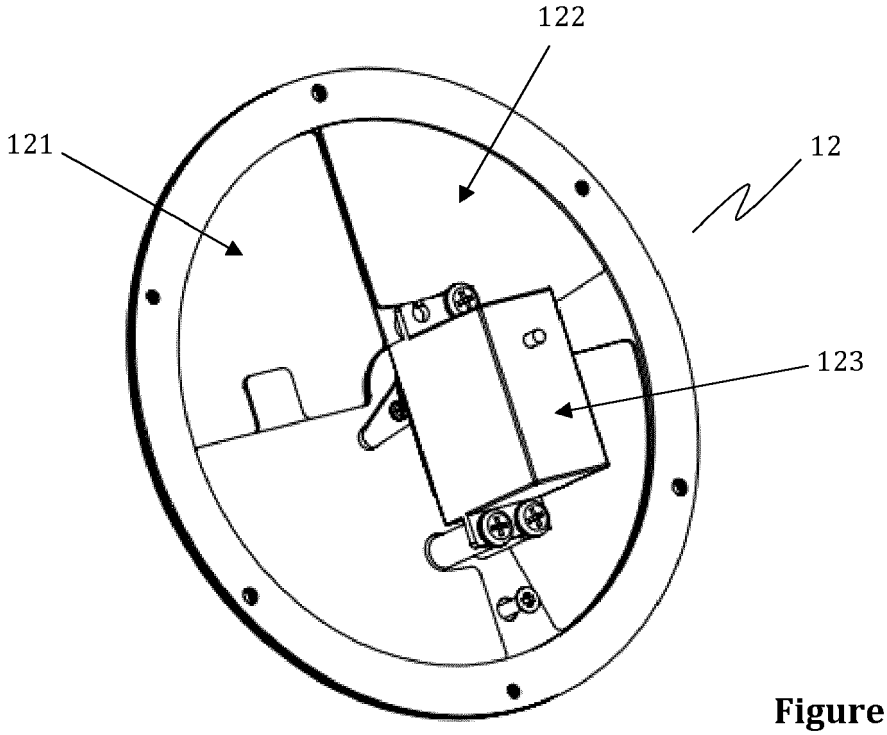


Figure 5c

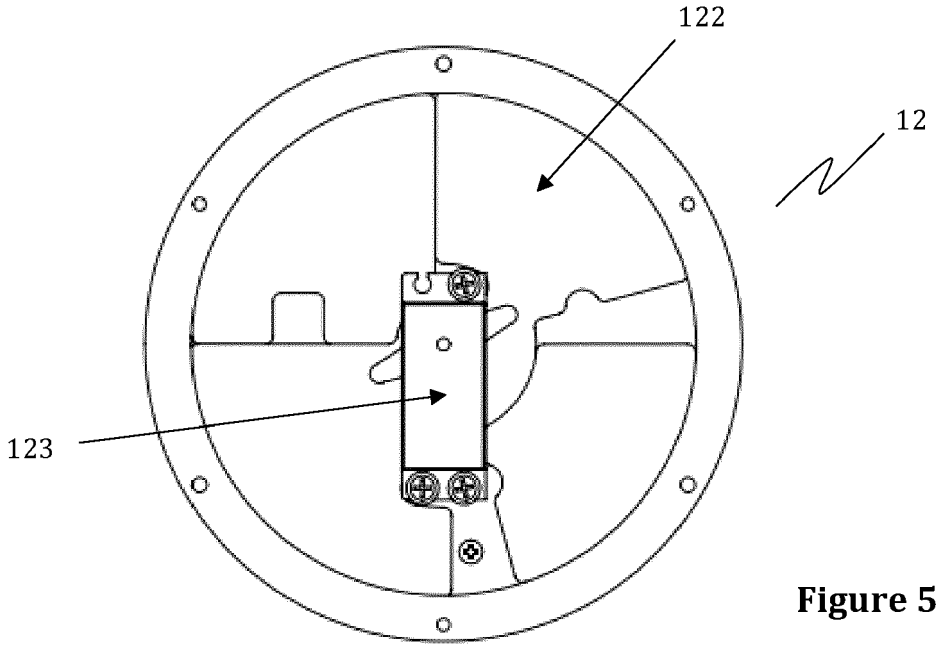


Figure 5d

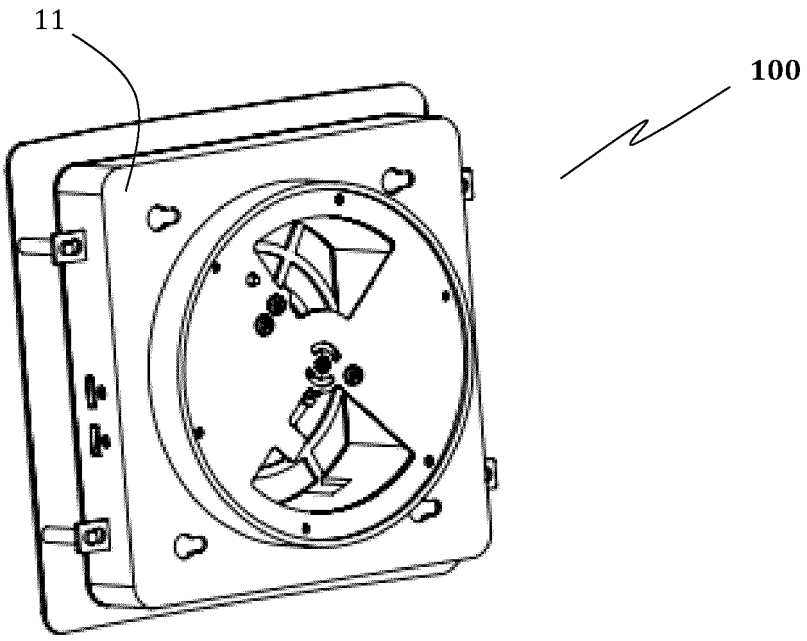


Figure 6a

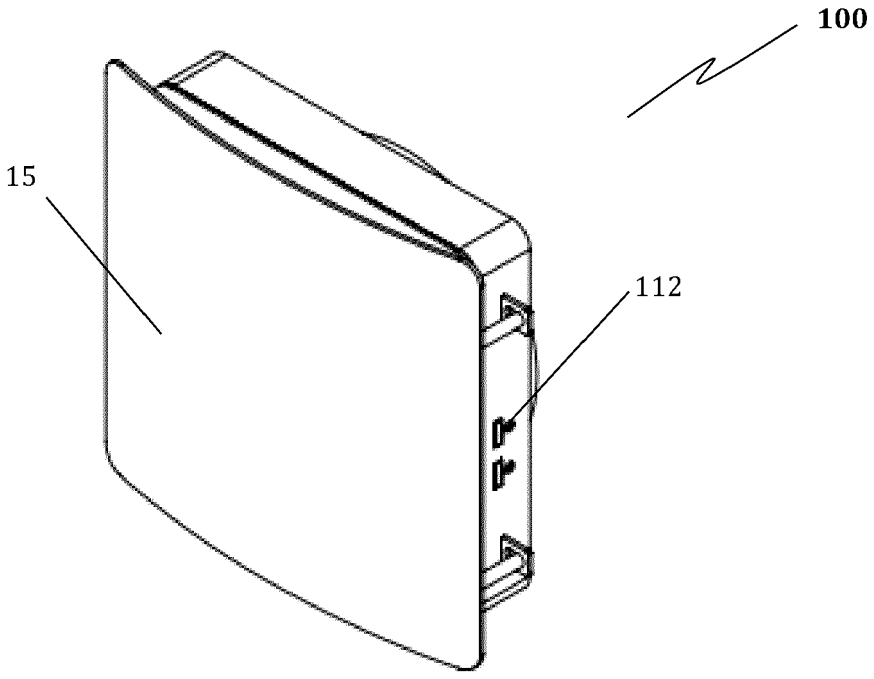


Figure 6b

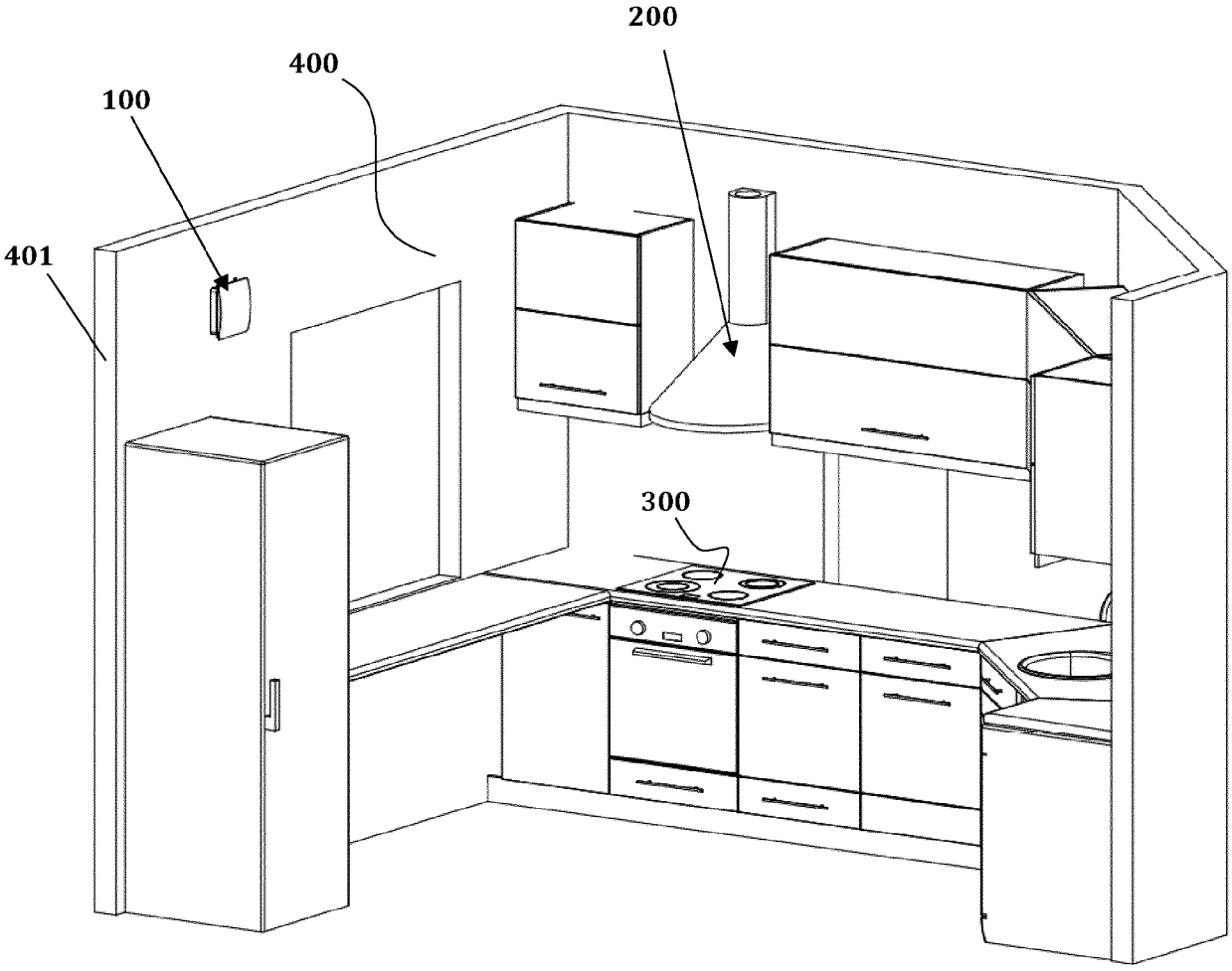


Figure 7

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# EUROPEAN SEARCH REPORT

Application Number
EP 20 20 1799

## 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<br>Y | WO 2014/174415 A1 (ELICA SPA [IT])<br>30 October 2014 (2014-10-30)<br>* figures 1,2 *<br>* page 3, lines 5-9 *<br>* page 3, line 19 - page 4, line 1 *<br>* page 4, lines 7-10, 14, 15 *<br>* page 5, lines 10-19 *<br>* page 6, lines 7-12 *<br>* page 7, lines 9,10,22-24 *<br>* page 8, lines 10-12 *<br>----- | 1-4,9,<br>10,12,13<br>11 | INV.<br>F24C15/20<br>F24F11/00<br>F24F11/56<br>F24F7/013 |
| X<br>Y | US 10 488 070 B1 (WOLFSON JASON [US])<br>26 November 2019 (2019-11-26)<br>* column 3, lines 25-27 *<br>* column 4, lines 22-38 *<br>* column 6, lines 6-13 *<br>* column 8, lines 4-9 *<br>* claim 23; figures 1-4 *<br>----- | 1,2,6-8,<br>13<br>5 | |
| X | JP 2010 145065 A (PANASONIC CORP)<br>1 July 2010 (2010-07-01)<br>* paragraph [0045]; figure 1 *<br>----- | 1-3,13 | TECHNICAL FIELDS SEARCHED (IPC)<br>F24C<br>F24F |
| Y | EP 3 431 883 A1 (SILVERLINE ENDUESTRI VE TICARET ANONIM SIRKETI [TR])<br>23 January 2019 (2019-01-23)<br>* figures 1-12 *<br>----- | 5 | |
| Y | US 6 669 547 B2 (UNIV NEBRASKA [US])<br>30 December 2003 (2003-12-30)<br>* column 3, lines 61-67 *<br>----- | 11 | |
| A | US 2010/318230 A1 (LIU GUOPENG [US])<br>16 December 2010 (2010-12-16)<br>* figures 1-5 *<br>----- | 1-13 | |
| | -/-- | | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 25 March 2021 | Fest, Gilles |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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# EUROPEAN SEARCH REPORT

Application Number
EP 20 20 1799

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 20 1799

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