(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 276 363 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.11.2023 Bulletin 2023/46

(21) Application number: **23165387.4**

(22) Date of filing: **30.03.2023**

(51) International Patent Classification (IPC):
F24C 15/20 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24C 15/2021

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **13.05.2022 TR 202207768**

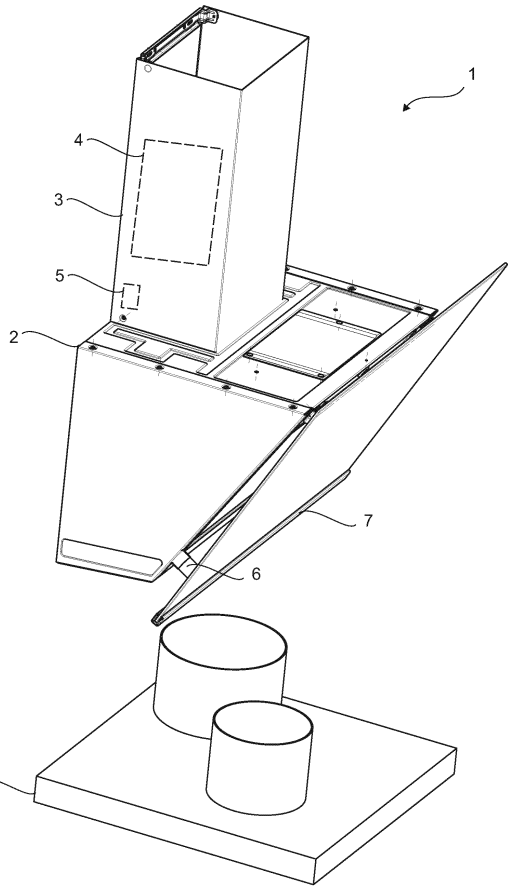
(71) Applicant: **Arçelik Anonim Sirketi**
34445 Istanbul (TR)

(72) Inventors:
- **ALTUNTAS, Hakan**
  34445 Istanbul (TR)
- **DONERKAYALI, Arda**
  34445 Istanbul (TR)
- **GUNDOGMU , Tulay**
  34445 Istanbul (TR)

(54) AN EXHAUST HOOD WITH IMPROVED AUTOMATIC OPERATION PERFORMANCE

(57) The present invention relates to an exhaust hood (1) which is positioned above cooking devices (8) such as cookers, countertop cookers and ovens so as to provide the removal of odor, smoke and moisture which occur during the cooking process, and which comprises a body (2); a suction channel (3) which is provided in the body (2); at least one fan (4) which is provided in the suction channel (3); at least one first temperature sensor (5) which is provided on the exhaust hood (1) and which detects the ambient temperature; at least two second temperature sensors (6) which detect the temperature of the air rising from the cooking device (8) or the cooking vessel thereon and which are disposed on the flow path of the air sucked into the suction channel (3); and a control unit (7) which enables the exhaust hood (1) to automatically operate according to the information received from the first and second temperature sensors (5 and 6) and which also enables the operation level to be automatically adjusted, and the second temperature sensors (6) are electrically connected in parallel.

Figure 1



EP 4 276 363 A1

Description

[0001] The present invention relates to an exhaust hood wherein the sensors are efficiently positioned to increase the automatic operation performance.

[0002] The exhaust hood provides the discharge of the water vapor and odor generated during the cooking process to the outside environment. With the development of sensor technologies, there are also important additional functions such as automatic operation and air purification.

[0003] The exhaust hood generally comprises a suction motor, a suction channel and a suction surface. The exhaust hood can be operated at different levels depending on the motor power in order to provide the discharge of the water vapor and odor generated during the cooking process to the outside environment. Said different levels can be selected by the user at appropriate stages according to the load of the cooking process.

[0004] In the state of the art, the user operates the exhaust hood when required during the cooking process and selects the appropriate level. In addition, there are applications where the exhaust hood is operated automatically to increase user comfort and to determine the most accurate level. In applications where the exhaust hood is operated and controlled automatically, sensors which monitor changes such as odor and temperature are used.

[0005] One of at least two temperature sensors on the exhaust hood measures the ambient temperature while the other temperature sensor detects whether the cooking device is operational or not from the temperature changes caused by the cooking process. By using at least two temperature sensors, it can be determined whether the cooker under the exhaust hood is operational or not, from the relative change (differences) between the temperature information measured by said sensors. Accordingly, it is provided that the exhaust hood is activated, the level is increased, and when the thermal load disappears, the level is reduced and the exhaust hood is closed.

[0006] In the state of the art, there are various alternatives for the placement of said sensors. However, the position of the sensor which monitors the cooker load and temperature is very critical. When the cooking process on the cooker starts, the load of the cooker must be detected without any error.

[0007] The sensor placed anywhere under the exhaust hood can measure the cooker load temperature when the exhaust hood is not operational. The sensor can also enable the exhaust hood to automatically switch to the first level at the specified stage. However, after the exhaust hood starts to operate, the air flow path changes direction towards the ventilation channel due to the suction. From this moment on, if the sensor is not placed in a correct position, in an area suitable for the air flow path, the cooker does not switch to the next level although the same continues to operate. Since the hot air is drawn by the exhaust hood at this time, the sensor remains out of the air flow path and starts to cool down even if the cooker is operational, transmitting incorrect information to the exhaust hood and causing the same to stop.

[0008] In addition, since the countertop cooker designs vary greatly, the cooking zones can be located at different positions. The thermal load which occurs during the cooking process in the cooking zones at these different positions follows a different flow path. The sensor, which is placed in any position under the exhaust hood, may remain within the air flow path of some cooking zones, while remaining outside the air flow path of some cooking zones. In this case, in the cooking processes performed in the cooking zones outside the air flow path, the sensor cannot complete the detection process for the automatic operation of the exhaust hood or may make an incorrect detection. Moreover, it becomes difficult to make homogeneous and accurate detection during the cooking process made in different cooking zones. In other words, there will be differences in the detection of the cooking processes done in a cooking zone far from the sensor position and the cooking process done in the cooking zone close to the sensor position. Due to all these reasons, the sensor must be placed at a suitable position that does not cause such problems in order to detect the cooker load, that is, the heat released due to the cooking process.

[0009] In order for the exhaust hood to perform the automatic operation function correctly, the sensor must be within the air flow path when the exhaust hood is operational or not, at every level and in every mode, in every type of cooker and in every cooking zone. To meet this condition, it is not sufficient to use only one sensor other than the reference sensor which monitors the ambient temperature. It is necessary to use more than one temperature sensor in order to correctly detect the temperature released by following more than one air flow path from different cooking zones in cooking devices which may have various designs.

[0010] Although increasing the number of sensors results in an increase in detection sensitivity, this causes an increase in the number of ports needed by the processor to drive and read the sensor. This situation requires a more costly processor, more circuit components and larger electronic board design.

[0011] In the state of the art German Patent Application No. DE102006041581, an exhaust hood which is prevented from overheating and a control method are disclosed.

[0012] In the state of the art Chinese Utility Model Document Application No. CN2491733, a smart exhaust hood comprising a control device is disclosed. In this document, two negative temperature coefficient thermistors are used as sensors. The thermistors are mounted directly onto the lower corners of the exhaust hood.

[0013] In the state of the art German Patent Application No. DE3922090, an exhaust hood is disclosed, comprising a temperature sensor placed on the outer surface thereof and measuring the ambient temperature and at

least two temperature sensors placed on the suction surface, wherein the fan is controlled according to temperature difference based on the information received from the sensors.

[0014] In the state of the art International Patent Application No. WO2020078670, an exhaust hood is disclosed, which is positioned above cooking devices such as cooker, oven, etc., comprising a body; a suction pipe; a fan which enables the air to be sucked and discharged to the outer environment; a guiding plate which is disposed on the lower surface of the body; an air suction duct; and one or more than one temperature sensor which measures the temperature of the air rising from the cooking device by heating up. This document also discloses the temperature sensor which is mounted at the center of the air suction duct between the guiding plate and the front panel, which is positioned in the flow path of the air, and which is enabled to be affected from the air flow at maximum. Thus, incorrect measurement is prevented while the temperature sensor performs its automatic operating functions.

[0015] In the state of the art embodiments, the detection sensitivity decreases and the transitions between the fan revolutions cannot be correctly realized. Especially when the exhaust hood is not operational, the sensors which read the static air temperature remain out of the hot air flow path which occurs when the cooking process is started, or when the level of the exhaust hood is changed, the operation of the suction motor at different powers causes the air flow path to change. Therefore, erroneous readings and detections occur since the hot air does not reach the sensor sufficiently.

[0016] The aim of the present invention is the realization of an exhaust hood wherein the sensors are efficiently positioned to increase the automatic operation performance.

[0017] The exhaust hood realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims, comprises at least one first temperature sensor which detects the ambient temperature; at least two second temperature sensors which detect the temperature of the air rising from a cooking device such as countertop cooker, oven, etc. or a cooking vessel thereon and which are disposed on the flow path of the air sucked; and a control unit which enables the exhaust hood to automatically operate according to the information received from the first and second temperature sensors and which also enables the operation level to be automatically adjusted; and the second temperature sensors are electrically connected in parallel.

[0018] In an embodiment of the present invention, NTC (negative temperature coefficient) sensors are used as the second temperature sensor. In order to use more than one second temperature sensor which detects the cooking device load and to eliminate the resulting need for excess microprocessor ports, the second temperature sensors are electrically connected to each other in parallel, thus allowing measurements to be taken from a single microprocessor ADC port. Thus, the exhaust hood is enabled to operate automatically with at least two second temperature sensors, the second temperature sensors are placed in the most effective way to detect the temperature of the cooking device load which enables the automatic operation thereof while providing solutions to the detection problems which arise in the state of the art.

[0019] By means of the present invention, the exhaust hood is enabled to automatically determine the operational level of the suction motor, depending on the cooking load, by means of electrically-connected temperature sensors. Moreover, by means of the present invention, in case of heating in any of the temperature sensor measuring the ambient temperature and the temperature sensors which are connected in parallel to a single microprocessor port and placed on the air flow paths between the cooking device and the exhaust hood suction motor, in different types of cookers, at different power and levels, at different exhaust hood levels, with different cooking vessels and placements, it is provided that

- the start of the cooking process in any one of the cooking zones of the cooking device is detected,
- the cooking process load and the powers/levels of the cooker are detected,
- the exhaust hood operational level (motor suction power) is automatically adjusted,
- the end of the cooking process is detected, and
- a single microprocessor port meets the need by connecting the temperature sensors to each other in parallel.

[0020] An exhaust hood realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the perspective view of an exhaust hood and a cooking device.

Figure 2 - is the sideways view of the exhaust hood and the cooking device.

[0021] The elements illustrated in the figures are numbered as follows:

1. Exhaust hood
2. Body
3. Suction channel
4. Fan

5. First temperature sensor

6. Second temperature sensor

7. Control unit

8. Cooking device

[0022] The exhaust hood (1) of the present invention is positioned above cooking devices (8) such as cookers, countertop cookers and ovens so as to provide the removal of odor, smoke and moisture which occur during the cooking process, and comprises a body (2); a suction channel (3) which is provided in the body (2); at least one fan (4) which is provided in the suction channel (3); at least one first temperature sensor (5) which is provided on the exhaust hood (1) and which detects the ambient temperature; at least two second temperature sensors (6) which detect the temperature of the air rising from the cooking device (8) or the cooking vessel thereon and which are disposed on the flow path of the air sucked into the suction channel (3); and a control unit (7) which enables the exhaust hood (1) to automatically operate according to the information received from the first and second temperature sensors (5 and 6) and which also enables the operation level to be automatically adjusted, and the second temperature sensors (6) are electrically connected in parallel. Thus, the load on the microprocessor caused by using more than one second temperature sensor (6) which detects the load of the cooking device (8) is minimized (Figure 1 and Figure 2).

[0023] By connecting two or more second temperature sensors (6) in parallel, the need to use more than one microprocessor port is eliminated and measurements are taken from a single microprocessor ADC port. Thus, the need for an extra microprocessor port caused by the use of an extra second temperature sensor (6) is eliminated by connecting the second temperature sensors (6) to each other in parallel. Consequently, it is provided that a more cost-effective microprocessor with fewer ports is preferred and the number of circuit components to be used and the size of the electronic card are minimized.

[0024] In the embodiment of the present invention, the exhaust hood (1) is automatically activated by the control unit (7) according to a relative difference between the load temperature of the cooking device (8) and the ambient temperature. According to the amount of this relative difference, the fan (4) operational levels are automatically adjusted by the control unit (7), and when the relative difference disappears, the end of the cooking process is detected and the operation of the exhaust hood (1) ends. In case the exhaust hood (1) does not operate and the hot air coming out of the cooking device (8) cannot reach the exhaust hood (1), when the automatic operation mode is started, the fan (4) is operated by the control unit (7) so as to perform a low amount of suction and the air is directed towards the second temperature sensors (6) on the air flow path. Thus, the increase in the load of the cooking device (8) is easily detected and the levels of the exhaust hood (1) are automatically changed by the control unit (7). In this embodiment of the present invention, if the automatic mode is activated by the control unit (7) while the exhaust hood (1) is not operation, if the measured cooking device (8) load temperature is higher than the ambient temperature, it is detected that a cooking process is being carried out and the exhaust hood (1) is operated directly at the relevant level by the control unit (7).

[0025] In an embodiment of the present invention, the second temperature sensors (6) are disposed into the suction channel (3). Thus, the cooking device (8) load temperature can be determined in the most efficient manner depending on the cooking process. The most accurate detection of the temperature of the cooking device (8) enables the exhaust hood (1) to be activated automatically at the right time.

[0026] In an embodiment of the present invention, NTC (negative temperature coefficient) sensors are used as the second temperature sensor (6). NTC sensors have a characteristic of decreasing resistance as temperature increases. In this case, when more than one second temperature sensor (6) is connected to each other in parallel, since the decrease in the resistance of only one will cause the equivalent resistance value to decrease, it is made possible to detect from only one ADC port. Thus, when the second temperature sensors (6) are placed in a position suitable for the air flow path, in case of heating in any one, the cooking process is detected to be performed on any cooking zone of the cooking device (8) while the load of this cooking process is also determined.

[0027] Thus, the exhaust hood (1) is enabled to operate automatically with at least two second temperature sensors (6), the second temperature sensors (6) are placed in the most effective way to detect the temperature of the cooking device (8) load which enables the automatic operation thereof while providing solutions to the detection problems which arise in the state of the art.

[0028] The use of two or more second temperature sensors (6) leads to the need for more ADC ports on the microprocessor side. However, by means of the present invention, thanks to the parallel connection of the second temperature sensors (6), it becomes possible to use more than one second temperature sensor (6) with only one microprocessor port, as if there is only one second temperature sensor (6) by means of parallel connection.

[0029] In another embodiment of the present invention, the exhaust hood (1) comprises the second temperature sensors (6) which are placed on the air flow path, between the front panel of the exhaust hood (1) and the suction duct (3), preferably at the most heated positions during the cooking process. In the preferred embodiment of the present invention, the second temperature sensors (6) are placed on the back of the front panel so as to face the cooking device (8).

[0030] In another embodiment of the present invention, the first temperature sensor (5), which measures the am-

bient temperature, is preferably placed in a position at the upper parts of the exhaust hood (1) so as not to be directly affected by the temperature of the cooking device (8).

[0031] By means of the present invention, the exhaust hood (1) is enabled to automatically determine the operational level of the suction motor, depending on the cooking load, by means of electrically-connected second temperature sensors (&). Moreover, by means of the present invention, in case of heating in any of the first temperature sensor (5) measuring the ambient temperature and the second temperature sensors (6) which are connected in parallel to a single microprocessor port and placed on the air flow paths between the cooking device (8) and the fan (4), in different types of cookers, at different power and levels, at different exhaust hood (1) levels, with different cooking vessels and placements, it is provided that the start of the cooking process in any one of the cooking zones of the cooking device (8) is detected, that the cooking process load and the powers/levels of the cooker are detected, that the exhaust hood (1) operational level (motor suction power) is automatically adjusted, that the end of the cooking process is detected, and that a single microprocessor port meets the need by connecting the second temperature sensors (6) to each other in parallel.

[0032] Furthermore, the need for an extra microprocessor port caused by the use of an extra second temperature sensor (6) is eliminated by connecting the second temperature sensors (6) to each other in parallel. Thus, a more cost-effective microprocessor with fewer ports is preferred. Consequently, it becomes possible to minimize both the number of circuit components to be used and the size of the electronic card.

Claims

1. An exhaust hood (1) which is positioned above cooking devices (8) such as cookers, countertop cookers and ovens so as to provide the removal of odor, smoke and moisture which occur during the cooking process, and **comprising** a body (2); a suction channel (3) which is provided in the body (2); at least one fan (4) which is provided in the suction channel (3); at least one first temperature sensor (5) which is provided thereon and which detects the ambient temperature; at least two second temperature sensors (6) which detect the temperature of the air rising from the cooking device (8) or the cooking vessel thereon and which are disposed on the flow path of the air sucked into the suction channel (3); and a control unit (7) which enables the automatic operation according to the information received from the first and second temperature sensors (5 and 6) and which also enables the operation level to be automatically adjusted, **characterized by** the second temperature sensors (6) which are electrically connected in parallel.

2. An exhaust hood (1) as in Claim 1, **characterized by** the control unit (7) which enables the exhaust hood (1) to be automatically activated according to a relative difference between the load temperature of the cooking device (8) and the ambient temperature.

3. An exhaust hood (1) as in Claim 1, **characterized by** the second temperature sensors (6) which are disposed into the suction channel (3).

4. An exhaust hood (1) as in Claim 1, **characterized by** the second temperature sensors (6) which are NTC sensors.

5. An exhaust hood (1) as in Claim 1, **characterized by** the second temperature sensors (6) which are placed on the air flow path, between the front panel of the exhaust hood (1) and the suction duct (3).

6. An exhaust hood (1) as in Claim 1, **characterized by** the first temperature sensor (5) which is disposed at a position at the upper regions of the exhaust hood (1).

Figure 1

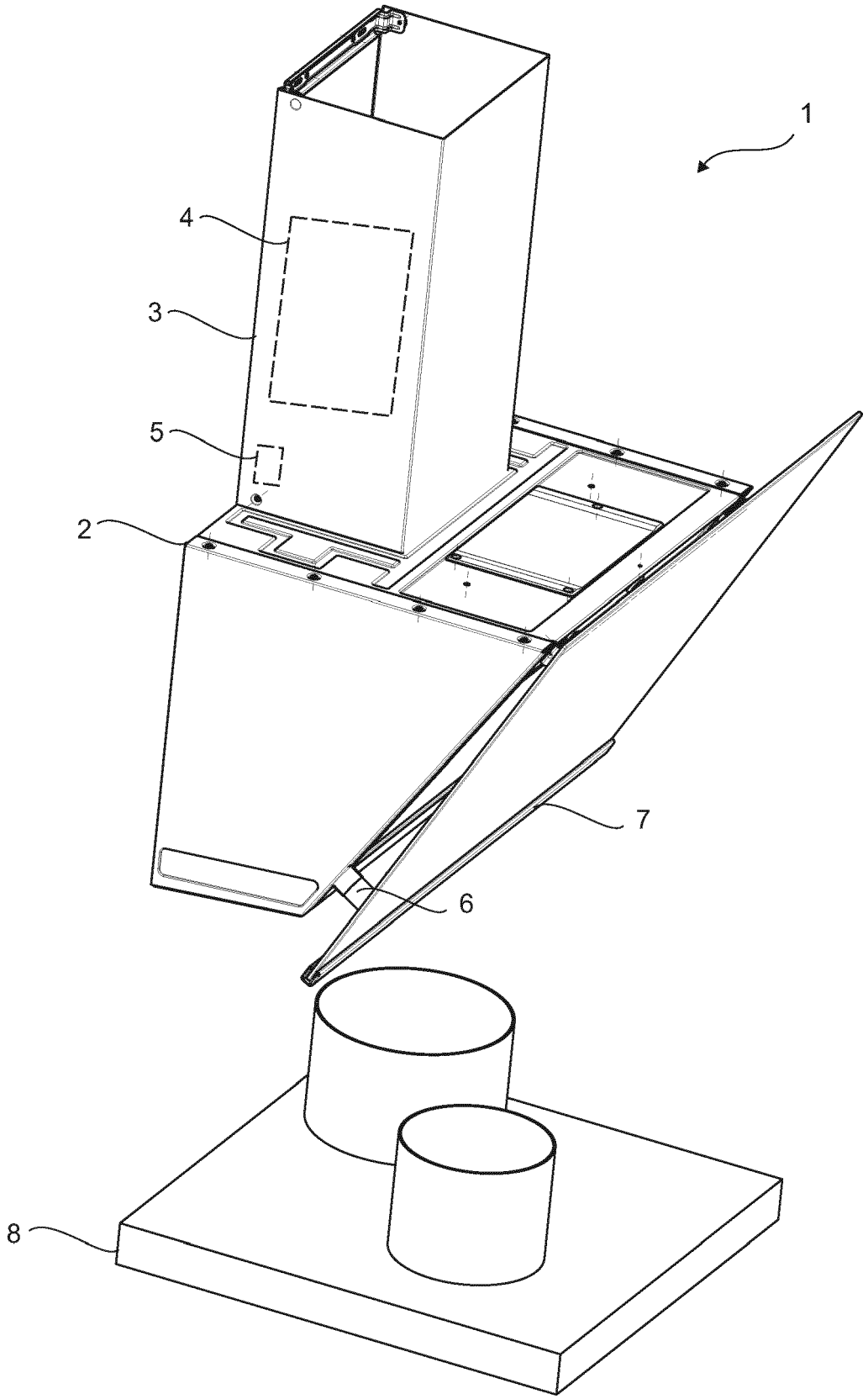
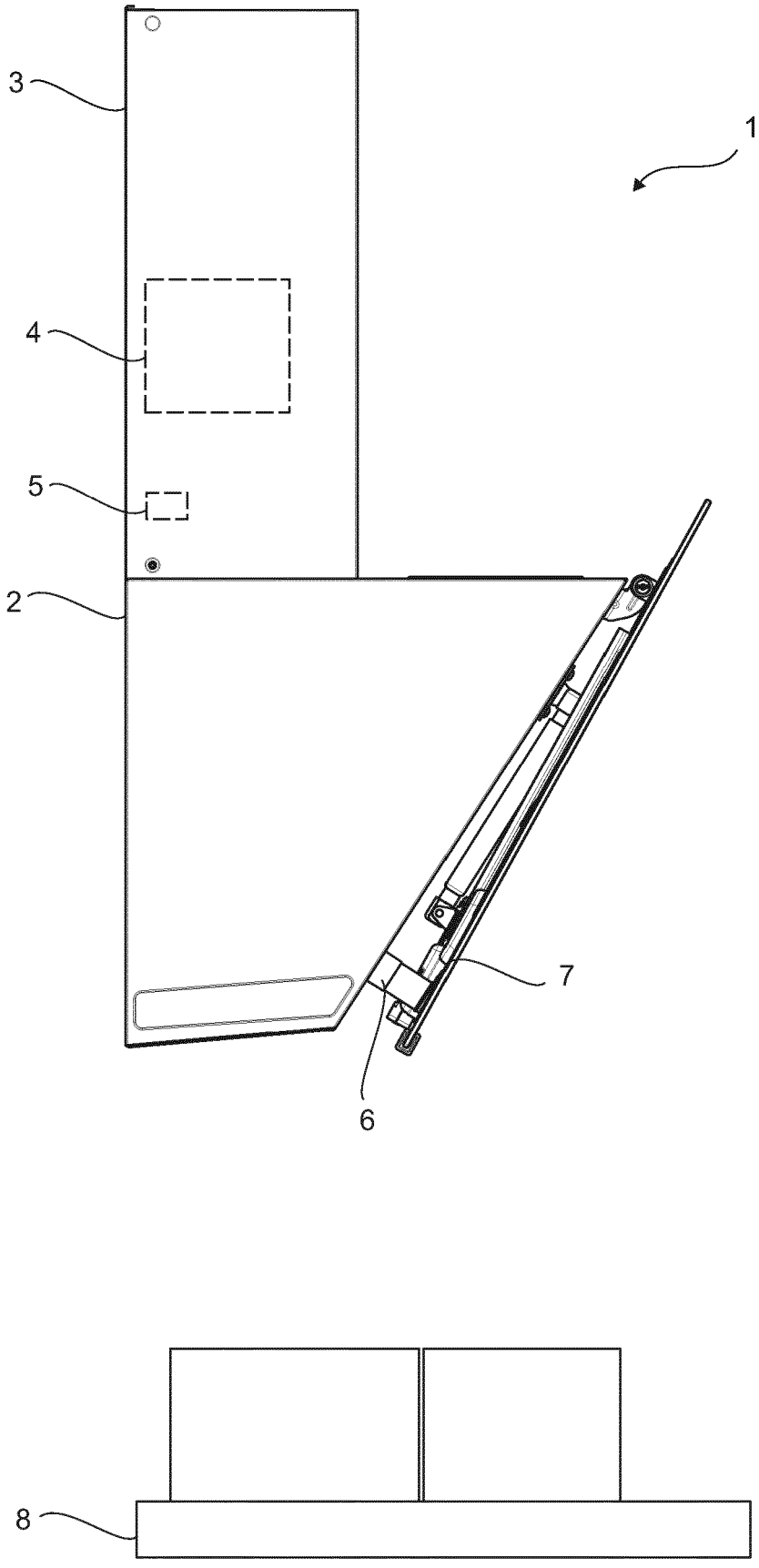


Figure 2



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 16 5387

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	CN 209 688 934 U (CHEN XITAO) 26 November 2019 (2019-11-26) * the whole document *	1,2,5,6 3,4	INV. F24C15/20
Y	CN 204 943 602 U (ZHANG WEIHAO) 6 January 2016 (2016-01-06) * figure 1 *	3	
Y	DE 39 22 090 A1 (RUHRGAS AG [DE]) 17 January 1991 (1991-01-17) * column 3, line 55 - column 4, line 18 *	4	
A	WO 2010/065793 A1 (HALTON GROUP LTD OY [FI]; LIVCHAK ANDREY V [US] ET AL.) 10 June 2010 (2010-06-10) * paragraphs [0046] - [0048]; figure 1 *	1	
A	EP 2 746 681 A1 (DIEHL AKO STIFTUNG GMBH & CO [DE]) 25 June 2014 (2014-06-25) * paragraphs [0032] - [0034]; figure 1 *	1	
A	CN 203 869 130 U (ZHEJIANG DELE ELECTRIC APPLIANCE CO LTD) 8 October 2014 (2014-10-08) * the whole document *	1	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	6 September 2023	Rodriguez, Alexander

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 16 5387

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-09-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 209688934 U	26-11-2019	NONE	
CN 204943602 U	06-01-2016	NONE	
DE 3922090 A1	17-01-1991	NONE	
WO 2010065793 A1	10-06-2010	AU 2009322238 A1	10-06-2010
		AU 2016200838 A1	25-02-2016
		BR PI0917043 B1	26-11-2019
		CA 2745432 A1	10-06-2010
		CN 102301187 A	28-12-2011
		CN 105757747 A	13-07-2016
		DK 2370744 T3	20-05-2019
		EP 2370744 A1	05-10-2011
		HK 1224359 A1	18-08-2017
		JP 5767974 B2	26-08-2015
		JP 6262117 B2	17-01-2018
		JP 6288657 B2	07-03-2018
		JP 2012511138 A	17-05-2012
		JP 2015028422 A	12-02-2015
		JP 2016217699 A	22-12-2016
		PL 2370744 T3	30-08-2019
		RU 2011122417 A	10-01-2013
		SG 171458 A1	28-07-2011
		US 2011284091 A1	24-11-2011
		US 2016377298 A1	29-12-2016
		US 2018363923 A1	20-12-2018
		WO 2010065793 A1	10-06-2010
		ZA 201103916 B	28-11-2018
EP 2746681 A1	25-06-2014	DE 102012024975 A1	26-06-2014
		EP 2746681 A1	25-06-2014
		US 2014174429 A1	26-06-2014
CN 203869130 U	08-10-2014	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 102006041581 **[0011]**
- CN 2491733 **[0012]**
- DE 3922090 **[0013]**
- WO 2020078670 A **[0014]**