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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 March 2020 (19.03.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/052856 A1

(51) International Patent Classification:
F25D 29/00 (2006.01)

(21) International Application Number:
PCT/EP2019/070481

(22) International Filing Date:
30 July 2019 (30.07.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
A 2018/13115 13 September 2018 (13.09.2018) TR

(71) Applicant: **ARCELIK ANONIM SIRKETI** [TR/TR]; Sutluce Karaagac Caddesi No: 2/6 Beyoglu, 34445 ISTANBUL (TR).

(72) Inventors: **OZTURK, Tansel**; E5 Ankara Asfalti Uzeri, Tuzla, 34950 ISTANBUL (TR). **MET, Aylin**; E5 Ankara Asfalti Uzeri, Tuzla, 34950 ISTANBUL (TR). **ARSAN, Ismet**; E5 Ankara Asfalti Uzeri, Tuzla, 34950 ISTANBUL (TR). **AKAN, Samet**; E5 Ankara Asfalti Uzeri, Tuzla, 34950 ISTANBUL (TR). **TOSUN, Isa**; E5 Ankara Asfalti Uzeri, Tuzla, 34950 ISTANBUL (TR).

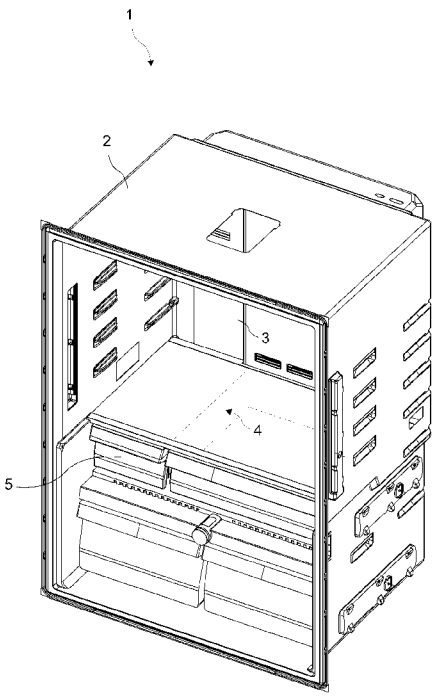
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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, 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))*

(54) Title: A REFRIGERATOR COMPRISING AN ODOR SENSOR

Figure 1



(57) Abstract: The present invention relates to a refrigerator (1) comprising a body (2); an evaporator which is disposed at the rear side of the body (2); an evaporator cover (3) which covers the front surface of the evaporator in the body (2); a storage compartment (4) wherein foodstuffs such as meat products, seafood, poultry, etc. are stored; a drawer (5) which can placed into/removed from the storage compartment (4) and wherein said foodstuffs are placed; an odor sensor (6) which detects the gases released from the foodstuffs and generating odor; and a control unit which evaluates the signals received from the odor sensor (6) and determines whether the foodstuffs are fresh or spoiled.

WO 2020/052856 A1

Description

A REFRIGERATOR COMPRISING AN ODOR SENSOR

[0001] The present invention relates to a refrigerator comprising an odor sensor which detects whether the foodstuffs placed into a storage compartment are fresh or spoiled.

[0002] Foodstuffs, in particular meat products, stored in special compartments in refrigerators may spoil in the course of time. The user generally decides that the foodstuff is spoiled by seeing the spoilage signs on the surface of the foodstuff and by smelling the undesired odors in the refrigerator. Although no spoilage signs are seen clearly on the surface of the foodstuff such as meat, etc. stored in the refrigerator, spoilage may start in the meat products and it becomes difficult for the user to detect if the spoilage has started. When the meat products start to spoil, they produce various gases such as ammonia. In the state of the art embodiments, whether the foodstuffs stored in the refrigerator have started to spoil or not is detected by gas sensors (odor sensors) and if the foodstuffs stored are spoiled, the user is warned to take the spoiled foodstuffs from the refrigerator. In some cases, when the amount of released gas is low, the gas sensors cannot detect the spoilage of the foodstuffs.

[0003] In the European Patent No. EP1055089 (B1), a temperature sensor, a humidity sensor and a gas sensor are provided in the food storage compartment in a cooling device and the values related to the ambient air in the storage compartment monitored by means of the said sensors are compared with the reference values and controlled. An opening that enables the air passage into the storage compartment is provided and the surface area that the air passes is adjusted by means of a closing member according to the data received from the sensors.

[0004] In the Patent Application No. JP2003106748 (A), whether the foodstuffs in the storage compartment release gas is detected, and upon the detection of gas release indicating the spoilage of the foodstuffs, the user is warned.

[0005] The Patent Application No. CN107178962 (A) relates to an odor sensor used in a refrigerator foodstuff storage compartment and to the method of odor detection.

[0006] The aim of the present invention is the realization of a refrigerator wherein the gases released by the foodstuffs such as meat products, etc. placed in a drawer in the storage compartment are detected by means of an odor sensor.

[0007] The refrigerator realized in order to attain the aim of the present invention comprises one or more than special storage compartment wherein in particular meat products are stored. The amount of gases such as ammonia, etc. released by the foodstuffs to be stored in the storage compartment when there are fresh and spoiled are predetermined by means of experimental studies and recorded in the control unit. The values detected by the odor sensor in the storage compartment are compared with the values recorded in the control unit, and thus whether the foodstuffs in the storage compartment are fresh or spoiled is determined.

[0008] The refrigerator of the present invention comprises an odor sensor which is fixed onto the inner surface of the rear wall or preferably onto the evaporator cover at the level of the rear wall and which extends from back to front into the inner volume of the refrigerator. The refrigerator further comprises a drawer which can be placed into/removed from the storage compartment and wherein the foodstuffs are placed, and a window which is arranged at the rear side of the drawer and through which the odor sensor passes to extend into the drawer when the drawer is placed into the storage compartment. The drawer is airtight, and a gasket is provided around the window through which the odor sensor passes. When the drawer is pushed to be seated into the storage compartment, the gasket around the window peripherally presses on the evaporator cover or the inner surface of the rear wall of the refrigerator. The drawer is covered by an elastic and leakproof drawer lid.

[0009] In an embodiment of the present invention, the odor sensor is enclosed by a sensor casing. The sensor casing protects the odor sensor against impacts, etc. and prevents the foodstuffs placed into the drawer and the user from getting in contact with the odor sensor. The openings provided on the sensor casing enable the gases released from the foodstuffs to enter the sensor casing and reach the odor sensor.

[0010] The refrigerator realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0011] Figure 1 - is the perspective view of a refrigerator.

[0012] Figure 2 - is the perspective view of a drawer which is disposed in the storage compartment and into which the odor sensor extends.

[0013] Figure 3 - is the cross-sectional view of the storage compartment when the drawer is placed therein.

[0014] Figure 4 - is the view of detail A in Figure 3.

[0015] Figure 5 - is the perspective view of the casing which carries the drawer in the storage compartment.

[0016] Figure 6 - is the perspective view of the casing when the drawer is placed therein.

[0017] Figure 7 - is the sideways view of the casing, the drawer and the lock detail.

[0018] Figure 8 - is the perspective view of a metal tray.

[0019] The elements illustrated in the figures are numbered as follows:

1. Refrigerator
2. Body
3. Evaporator cover
4. Storage compartment
5. Drawer
6. Odor sensor
7. Window
8. Gasket
9. Drawer lid
10. Sensor casing
11. Opening
12. Casing
13. Rail
14. Lock
15. Air guiding hole
16. Metal tray

[0020] The refrigerator (1) comprises a body (2); an evaporator (not shown in

figures) which is disposed at the rear side of the body (2); an evaporator cover (3) which covers the evaporator at the rear-inner surface of the body (2); a storage compartment (4) wherein foodstuffs such as meat products, seafood, poultry, etc. are stored; a drawer (5) which can placed into/removed from the storage compartment (4) and wherein said foodstuffs are placed; an odor sensor (6) which detects the gases released from the foodstuffs and generating odor; a control unit (not shown in figures) which evaluates the signals received from the odor sensor (6) and determines whether the foodstuffs are fresh or spoiled.

[0021] The refrigerator (1) of the present invention comprises

[0022] - the odor sensor (6) which is fixed onto the rear-inner surface of the body (2) or the evaporator cover (3) and which extends into the storage compartment (4), and

[0023] - a window (7) which is arranged at the rear wall of the drawer (5) and through which the odor sensor (6) passes when the drawer (5) is placed into the storage compartment (4) to extend into the drawer (5).

[0024] The refrigerator (1) further comprises a gasket (8) which surrounds the window (7) and hence the odor sensor (6) and which provides airtightness between the drawer (5) and the inner volume of the body (2) by peripherally bearing against the surface of the evaporator cover (3) or the rear-inner surface of the body (2) whereon the odor sensor (6) is fixed when the drawer (5) is placed into the storage compartment (4), and an airtight and elastic drawer lid (9) which covers the upper side of the drawer (5).

[0025] When the drawer (5) is seated into the storage compartment (4), the odor sensor (6) extends through the window (7) into the drawer (5). The gasket (8) which surrounds the window (7) presses onto the evaporator cover (3) or onto the rear-inner surface of the body (2), the upper side of the drawer (5) is closed with the drawer lid (9), thus creating a complete airtightness. Gas/odor molecules released as a result of the spoilage of foodstuffs have a different density with respect to air. The odor molecules released from the foodstuffs in the airtight drawer (5) reach the odor sensor (6) by natural convection. The odor sensor (6) detects the gases released from the

foodstuffs in a precise manner, and sends signals on whether in particular meat products are fresh or have started to spoil to the control unit.

[0026] In an embodiment of the present invention, the refrigerator (1) comprises a sensor casing (10) which is mounted into the drawer (5) or onto the rear-inner surface of the body (2) or onto the evaporator cover (3) and which surrounds and encloses the odor sensor (6), and at least one opening (11) which is arranged on the sensor casing (10). The sensor casing (10) protects the odor sensor (6) against external factors, impacts, etc. and prevents the foodstuffs placed into the drawer (5) and the user from getting in contact with the odor sensor (6). The openings (11) enable the gases released from the foodstuffs into the drawer (5) to enter the sensor casing (10) and reach the odor sensor (6).

[0027] In another embodiment of the present invention, the refrigerator (1) comprises a casing (12) which is disposed in the storage compartment (4) and which supports the drawer (5) so as to move forward and backward. The storage compartment (4) is positioned between two consecutive shelves in the body (2) or between the upper wall of the crisper and a shelf, and the casing (12) is fixed to the shelf above. The shelf (12) comprises at least one rail (13) which enables the drawer (5) to move forward-backward.

[0028] The drawer (5) is configured to be completely taken out and washed by the user. It is preferred to place in particular the meat products on a metal tray (16) in the drawer (5). The metal tray (16) is configured so as to prevent the meat products from contacting the plastic drawer (5), thus providing the rapid cooling of the meat products.

[0029] In another embodiment of the present invention, the refrigerator (1) comprises a lock (14) which is composed of a protrusion (or recess) arranged on at least one rail (13) on the casing (12) and of a recess (or protrusion) arranged on the drawer (5). Thus, upon being placed and pushed into the casing (12), the drawer (5) is properly fitted and fixed. The gasket (8) presses onto the evaporator cover (3) or the rear-inner surface of the body (2), thus improving airtightness. Moreover, the lock (14) prevents the drawer (5) from being dislodged during the transport of the

refrigerator (1).

[0030] In another embodiment of the present invention, the refrigerator (1) comprises at least one air guiding hole (15) which is arranged on the evaporator cover (3) or the rear-inner surface of the body (2) and which enables cool air to be blown onto the outer surfaces of the drawer (5) to be cooled from the outside. The air which circulates in the body (2) and which is blown through the air guiding holes (15) passes, without entering the drawer (5), in between the drawer (5) and the lower shelf or the crisper cover and/or in between the drawer (5) and the upper shelf and/or outside the side walls of the drawer (5) so as to cool the drawer (5) from the outside. Since the air which circulates in the body (2) does not mix with the gases in the drawer (5), the density of the latter does not change.

[0031] In another embodiment of the present invention, the storage compartment (4) is used as a "zero degree compartment" wherein storage conditions at zero degree (0°C) are provided.

[0032] In the refrigerator (1) of the present invention wherein the odor sensor (6) is used, a complete airtightness is provided at the drawer (5) in the storage compartment (4) wherein in particular meat products are placed by means of the gasket (8) around the window (7) and the elastic drawer lid (9). The odor sensor (6) is enabled to carry out its functions in a precise and quick manner even if there is a low amount of gas release.

Claims

1. A refrigerator (1) **comprising** a body (2); an evaporator cover (3) which covers the evaporator at the rear-inner surface of the body (2); a storage compartment (4) wherein foodstuffs are stored; a drawer (5) which can placed into/removed from the storage compartment (4) and wherein said foodstuffs are placed; and an odor sensor (6) which detects the gases released from the foodstuffs and generating odor, **characterized by**
   - the odor sensor (6) which is fixed onto the rear-inner surface of the body (2) or the evaporator cover (3), and
   - a window (7) which is arranged at the rear wall of the drawer (5) and through which the odor sensor (6) passes when the drawer (5) is placed into the storage compartment (4) to extend into the drawer (5).
2. A refrigerator (1) as in Claim 1, **characterized by** a gasket (8) which surrounds the window (7) and which peripherally bears against the surface of the evaporator cover (3) or the rear-inner surface of the body (2) whereon the odor sensor (6) is fixed when the drawer (5) is placed into the storage compartment (4).
3. A refrigerator (1) as in Claim 1 or 2, **characterized by** a drawer lid (9) which covers the upper side of the drawer (5) and which is elastic.
4. A refrigerator (1) as in Claim 1 or 2, **characterized by** a sensor casing (10) which is mounted into the drawer (5) or onto the rear-inner surface of the body (2) or onto the evaporator cover (3) and which surrounds and encloses the odor sensor (6).
5. A refrigerator (1) as in Claim 4, **characterized by** at least one opening (11) which is arranged on the sensor casing (10).
6. A refrigerator (1) as in Claim 1 or 2, **characterized by** a casing (12) which is disposed in the storage compartment (4) and which supports the drawer (5) so as to move forward and backward.
7. A refrigerator (1) as in Claim 6, **characterized by** the storage compartment (4) which is disposed between two consecutive shelves in the body (2) and the casing (12) which is fixed to the shelf above.
8. A refrigerator (1) as in Claim 7, **characterized by** the casing (12) comprising at least one rail (13) which enables the drawer (5) to move forward and

backward.

9. A refrigerator (1) as in Claim 8, **characterized by** a lock (14) which is composed of a protrusion (or recess) arranged on at least one rail (13) on the casing (12) and of a recess (or protrusion) arranged on the drawer (5).
10. A refrigerator (1) as in Claim 1 or 2, **characterized by** at least one air guiding hole (15) which is arranged on the evaporator cover (3) or the rear-inner surface of the body (2) and which enables cool air to be blown onto the outer surfaces of the drawer (5) to be cooled from the outside.
11. A refrigerator (1) as in Claim 1 or 2, **characterized by** the storage compartment (4) which is used as a "zero degree compartment" wherein storage conditions at zero degree are provided.

Figure 1

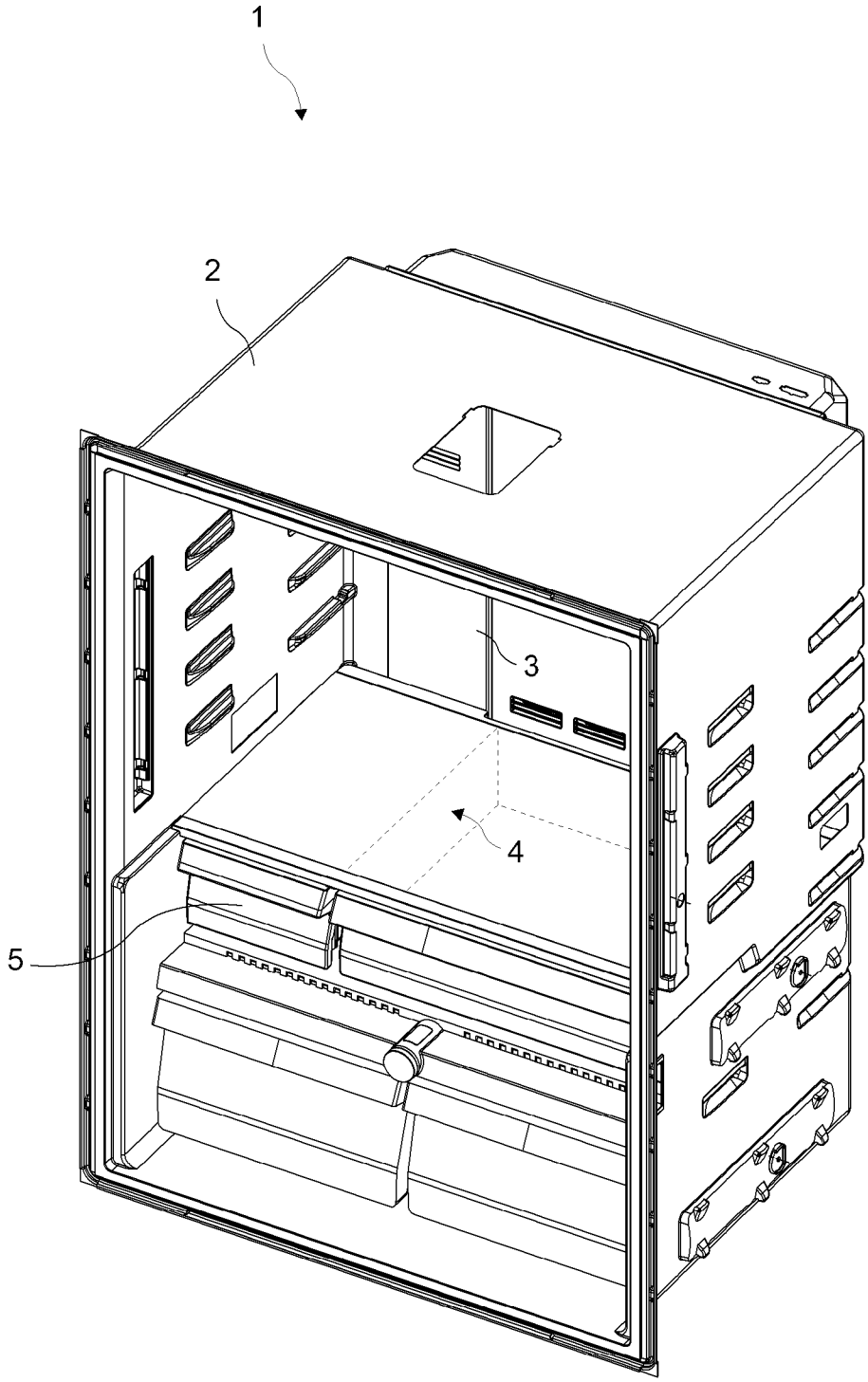


Figure 2

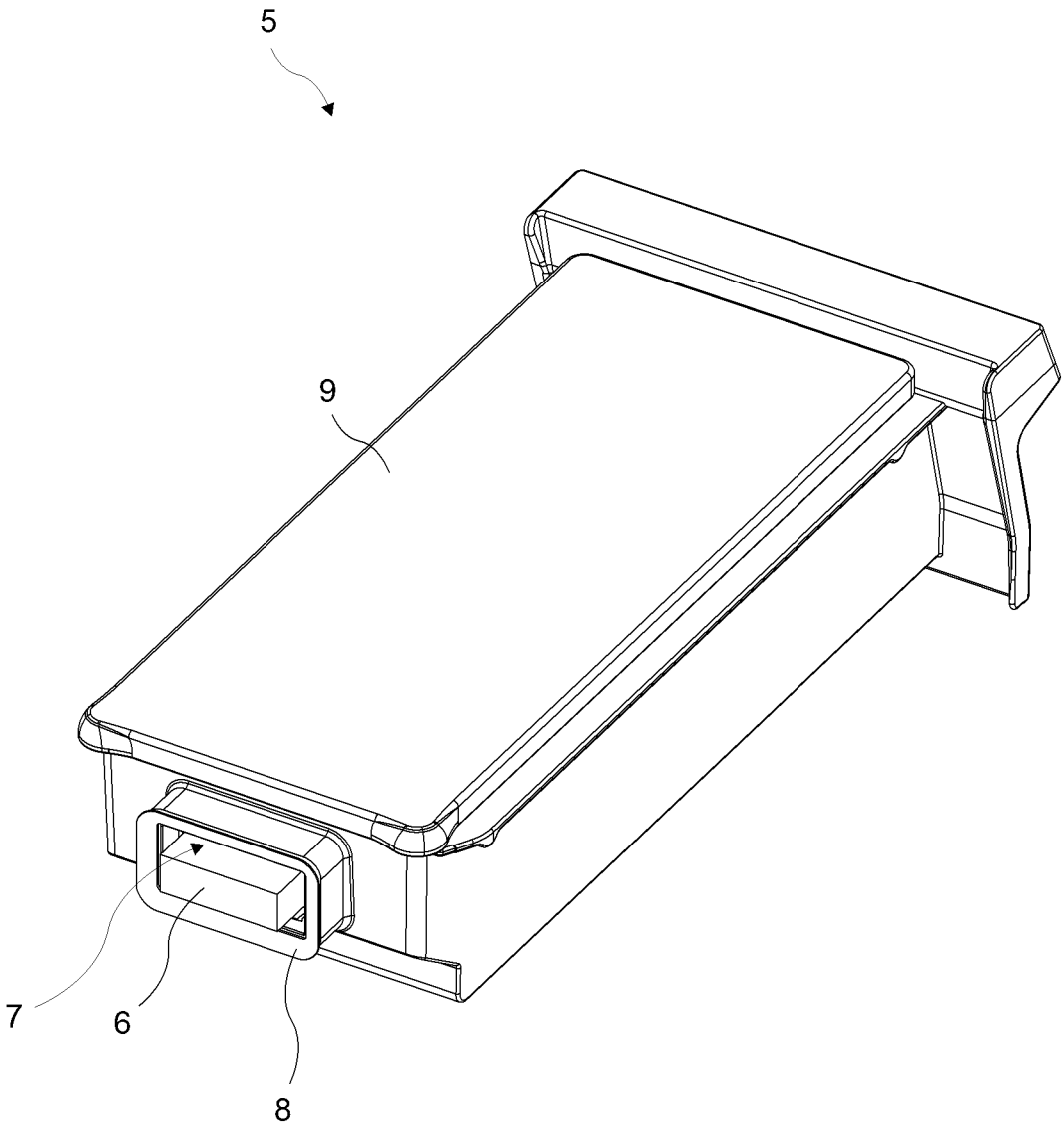


Figure 3

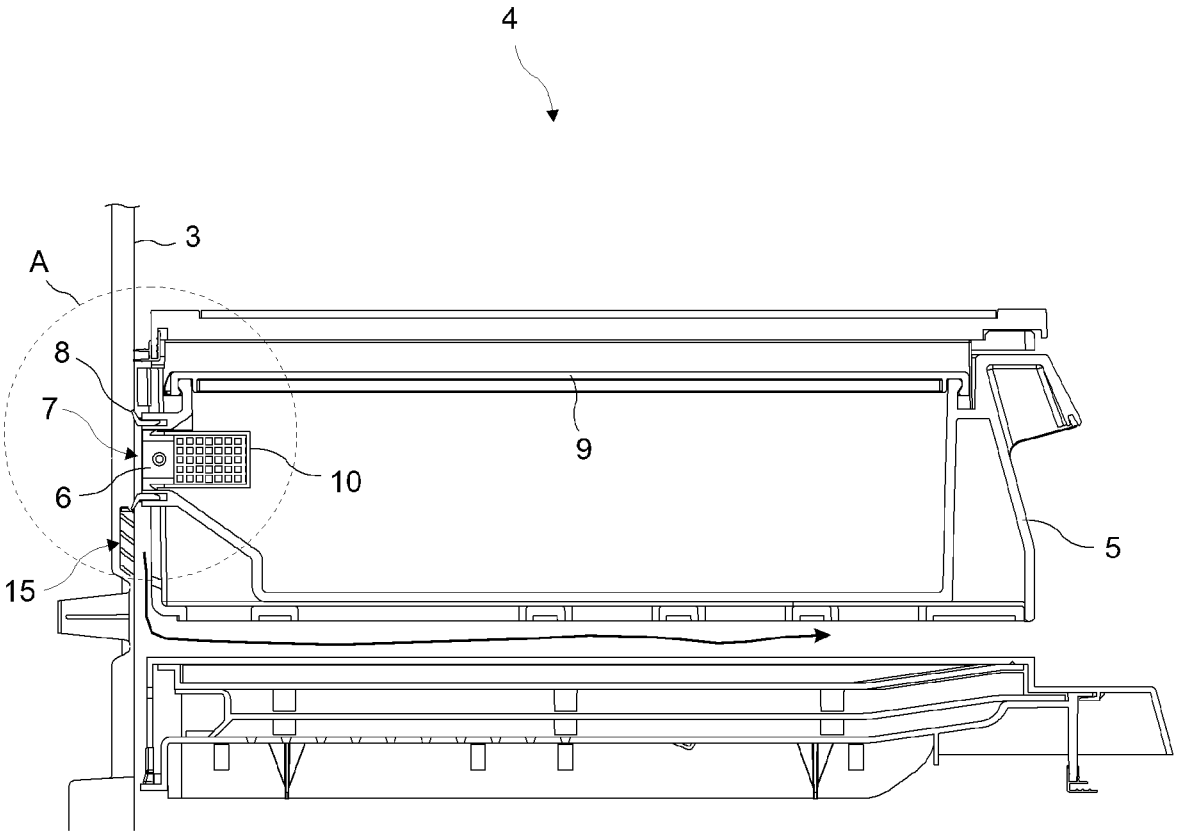


Figure 4

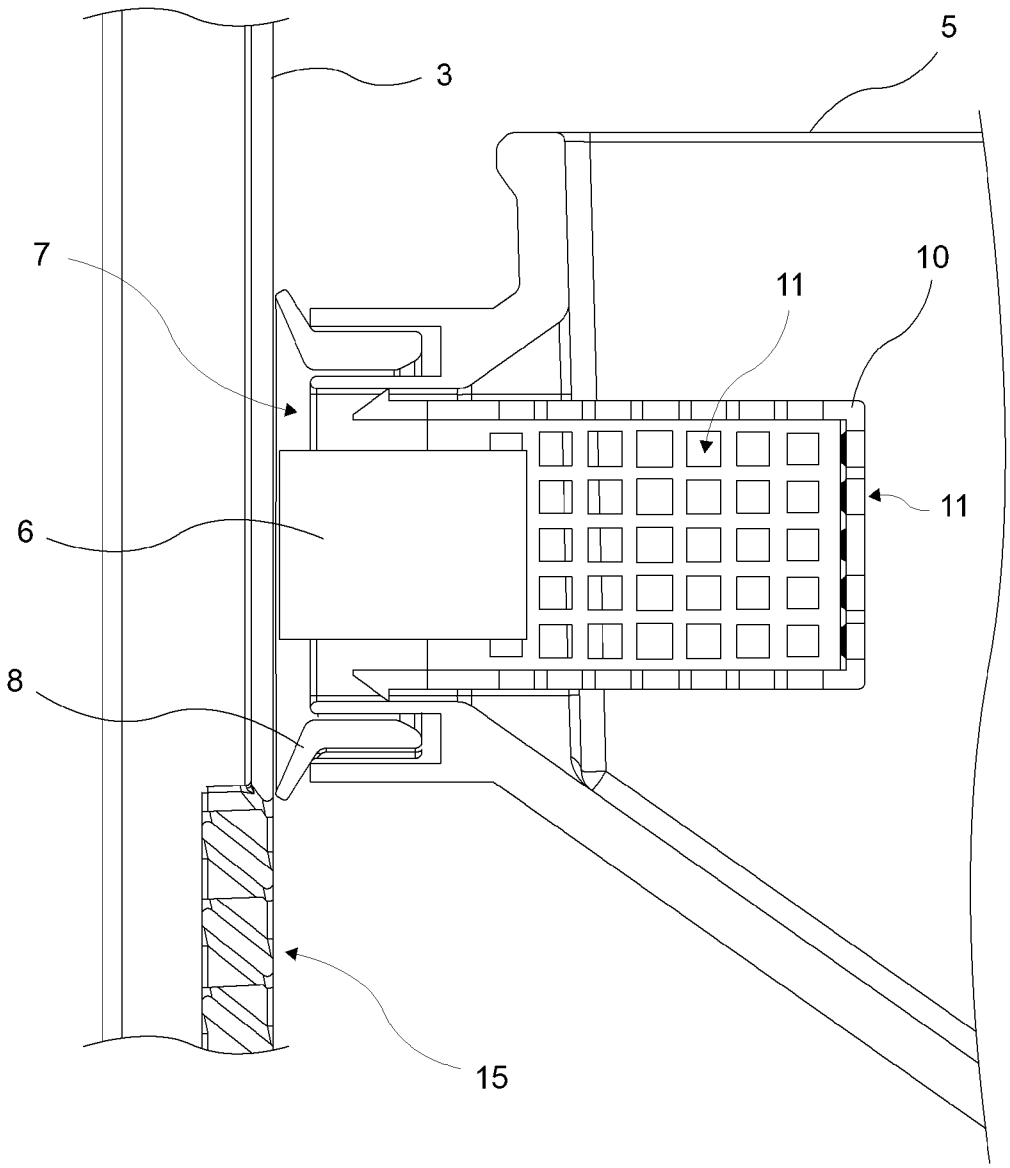


Figure 5

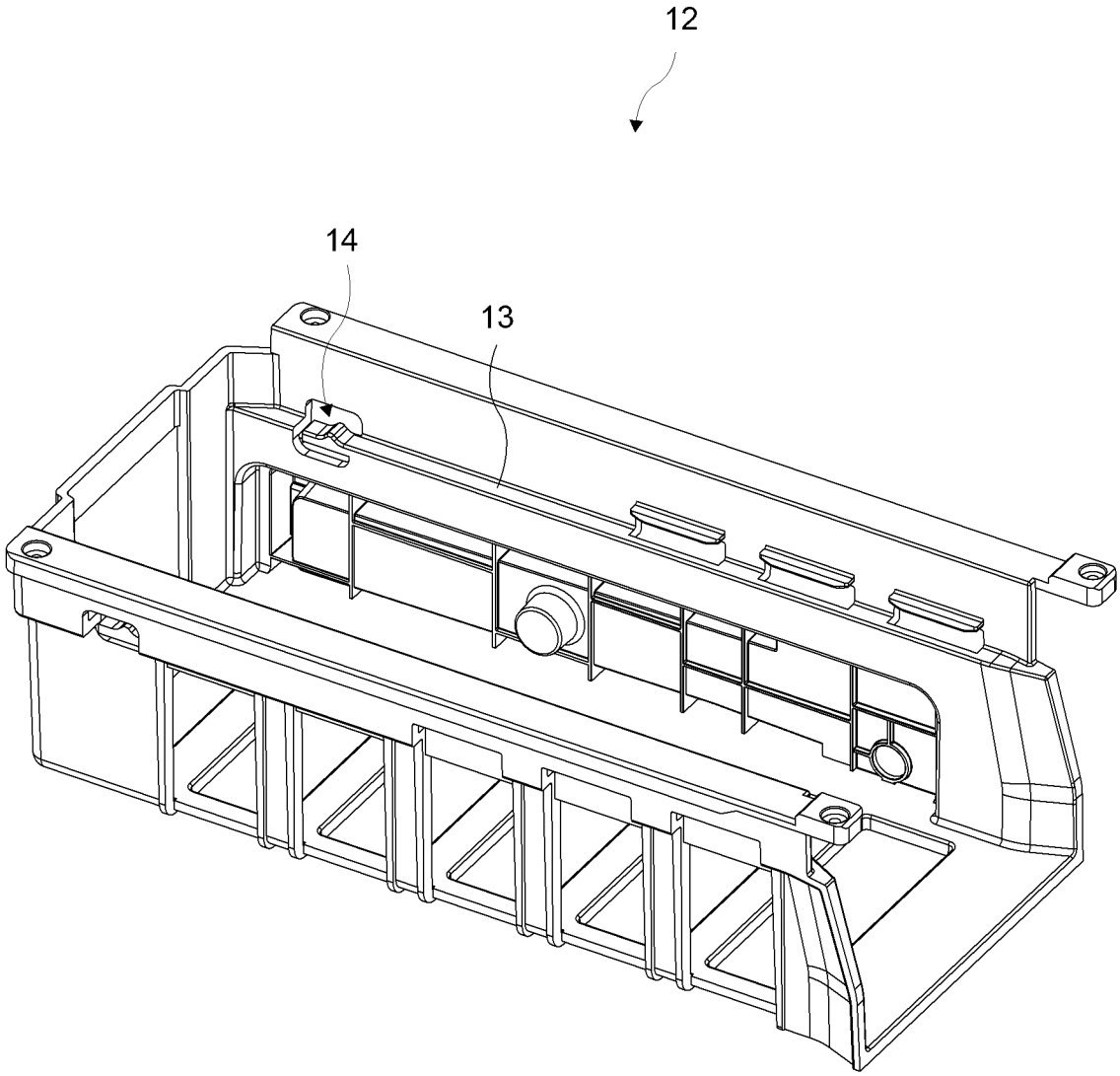


Figure 6

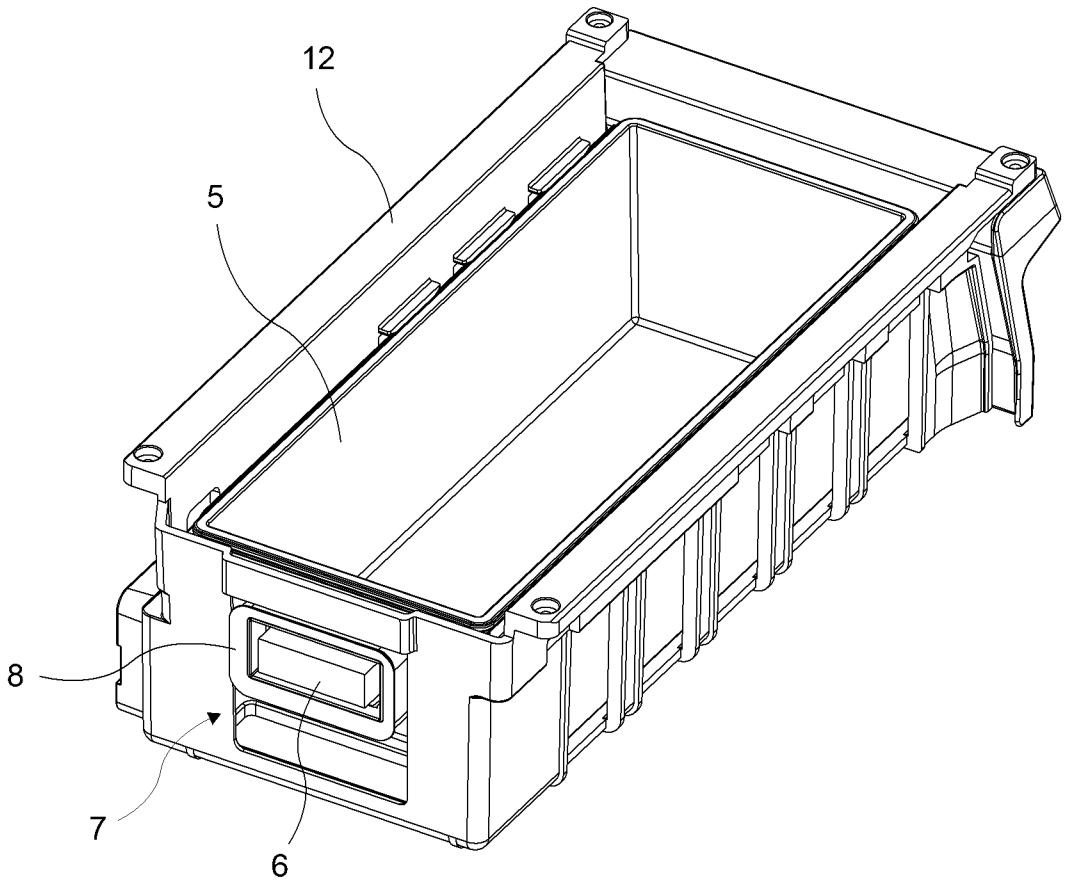


Figure 7

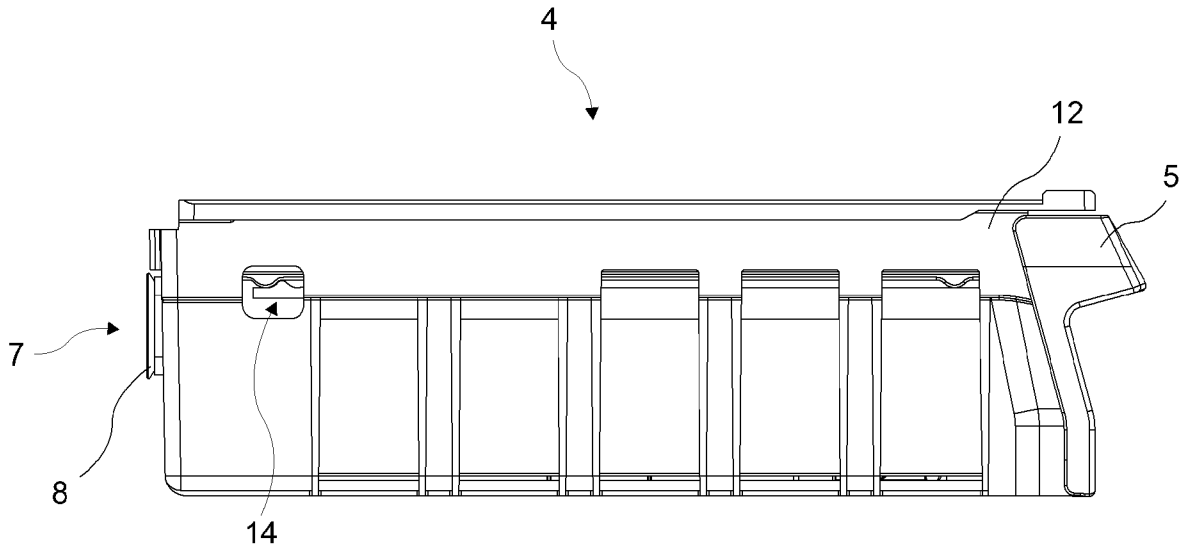
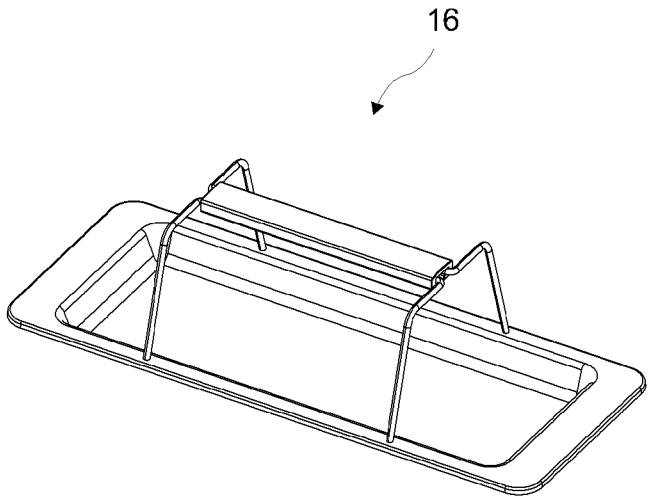


Figure 8



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/070481

A. CLASSIFICATION OF SUBJECT MATTER
INV. F25D29/00
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)
F25D

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.
X	WO 2018/063129 A2 (ARCELIK AS [TR]) 5 April 2018 (2018-04-05) page 3, lines 6-20; figures 1,3	1-11
X	JP H02 225988 A (TOSHIBA CORP; TOSHIBA AUDIO VIDEO ENG) 7 September 1990 (1990-09-07) paragraphs [0001] - [0003]; figure 9	1-11
X	US 2006/117763 A1 (ESPINOSA EDWARD P [US] ET AL) 8 June 2006 (2006-06-08) paragraph [0039]; figures	1-11
X	EP 2 947 405 A1 (WHIRLPOOL CO [US]) 25 November 2015 (2015-11-25) paragraph [0037]; claim 3; figure 1	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 September 2019	27/09/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Vigilante, Marco

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/070481

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018063129 A2	05-04-2018	EP 3507555 A2	10-07-2019
		TR 201612293 A2	21-03-2018
		WO 2018063129 A2	05-04-2018
JP H02225988 A	07-09-1990	NONE	
US 2006117763 A1	08-06-2006	CA 2641545 A1	10-08-2006
		EP 1853854 A2	14-11-2007
		US 2006117763 A1	08-06-2006
		US 2008060376 A1	13-03-2008
		US 2011094190 A1	28-04-2011
		US 2013156912 A1	20-06-2013
		US 2015037477 A1	05-02-2015
		US 2017082345 A1	23-03-2017
		WO 2006083912 A2	10-08-2006
EP 2947405 A1	25-11-2015	EP 2947405 A1	25-11-2015
		US 2015335038 A1	26-11-2015
		US 2017003065 A1	05-01-2017