



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.12.2021 Bulletin 2021/51

(51) Int Cl.:
F25D 17/04 (2006.01) F25D 25/02 (2006.01)

(21) Application number: **21171568.5**

(22) Date of filing: **30.04.2021**

(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 MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **BACAK, Cihat**
34445 ISTANBUL (TR)
• **USLU, Cetin**
34445 ISTANBUL (TR)
• **DINCER, Kemal**
34445 ISTANBUL (TR)
• **ALTINTAS, Halil Ibrahim**
34445 ISTANBUL (TR)
• **INAL, Tayfun**
34445 ISTANBUL (TR)

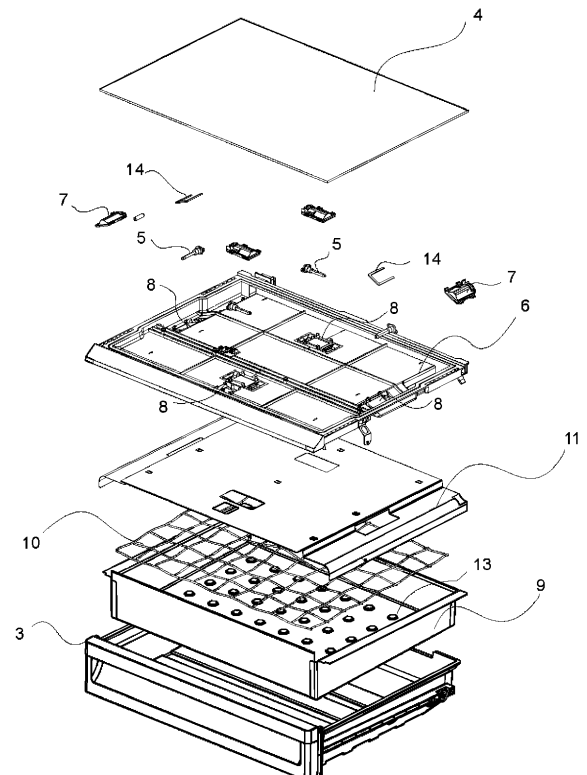
(30) Priority: **15.06.2020 TR 202009227**

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

(54) **A REFRIGERATOR COMPRISING A UV LIGHT SOURCE**

(57) The present invention relates to a refrigerator (1) comprising a body (2); a compartment (3) which is disposed in the body (2) and wherein the foodstuffs are placed; a shelf (4) which is disposed in the body (2); and at least one UV light source (5) which is positioned so as to emit light into the compartment (3), the refrigerator further comprising a carrier plate (6) having a housing (8) wherein the at least one UV light source (5) is placed so as to emit light into the compartment (3) in an angled manner.

Figure 3



Description

[0001] The present invention relates to a refrigerator comprising at least one UV light source for disinfecting the foodstuffs placed therein, wherein the rays emitted by the UV light source are suffused over all the surfaces of the foodstuffs so as to increase the efficiency thereof.

[0002] There are many pathogenic microorganisms such as bacteria, viruses or harmful substances such as pesticide residues on the packaged foods, fruits and vegetables placed in the refrigerator. Especially when the packaged foods are placed in compartments without being cleaned, harmful microorganisms and substances on the packages directly threaten human health. Moreover, although vegetables and fruits are consumed after being washed, sometimes cleaning with water is not sufficient to remove bacteria and viruses.

[0003] In the state of the art, in order to provide the user with cleaner and safer foodstuffs, there are refrigerators comprising crispers having an ozone generator, shelves or crispers with UV light sources.

[0004] In the state of the art Korean Patent Document No. KR20050026739, a refrigerator is disclosed, having a strip-shaped glass with UV light sources placed on the sides of a shelf.

[0005] In the state of the art European Patent Document No. EP2525173B1, UV light sources are disclosed which are placed on a compartment so as to be above the photocatalytic member placed onto the compartment base.

[0006] The aim of the present invention is the realization of a refrigerator comprising UV light sources which are placed so as to enable the UV rays to suffuse over all the surfaces of the foodstuffs in order to ensure disinfection in the compartment wherein the foodstuffs are placed.

[0007] The refrigerator of the present invention comprises a carrier plate which is placed in the body of the refrigerator so as to be on the compartment wherein the foodstuffs are placed in order to sterilize the foodstuffs. The carrier plate comprises at least one UV light source which is positioned so as to be parallel with the compartment base and which provides light in a manner perpendicular to the compartment, and at least another UV light source which is disposed on the carrier plate in an angled manner so as to be close to the center of the compartment base in order to enable the UV rays to reach the central regions.

[0008] The carrier plate comprises housings for receiving the UV light sources. The UV light sources which are placed in an angled manner are attached into the housings on the carrier plate which are angled with respect to the compartment base.

[0009] In the primary embodiment of the present invention, the housings wherein the UV light sources are attached comprise at least one of the reflective materials which are Teflon, aluminum, magnesium, calcium carbonate, silicon or zirconium dioxide.

[0010] In an embodiment of the present invention, the UV light sources are mounted into the housing by means of holders. In said embodiment, the holder is coated with a reflective material which is Teflon, aluminum, magnesium, calcium carbonate, silicon or zirconium dioxide or is completely produced from a reflective material.

[0011] The thickness of the coating is between 0.1 micron and 5 mm, and the coating is carried out preferably by anodized coating method.

[0012] In the preferred embodiment of the present invention, the UV light source is a source which emits in the UVC wavelength. The UVC light sources emit a light in the range of 160-280 nm.

[0013] Quartz glasses are attached in front of the UV light sources so as to cover the housings to which the UV light sources are mounted and/or the holder. The light in the UVC wavelength does not pass through plastic or other glasses. Thus, the UV rays are enabled to spread in the compartment.

[0014] The refrigerator of the present invention comprises at least one elastic member which is placed between the holder and/or the housing and the quartz glass in order to dampen the possible impacts. In the preferred embodiment of the present invention, said elastic member is a sponge.

[0015] Voltage converters are provided in the compartment to operate the UV light sources.

[0016] In an embodiment of the present invention, a top plate is placed between the carrier plate and the compartment in order to prevent light leaks from the carrier plate to the outside of the compartment and to ensure that the carrier plate is not damaged by the UV rays. Said top plate comprises a metal material, preferably stainless steel.

[0017] A reflector is disposed in the compartment in order to increase the mission of the UV rays. Elevations which increase the diffraction of the light are provided on the reflector surface. In a preferred embodiment of the invention, said elevations are circular and/or polygonal and arranged in the horizontal and vertical plane on the reflector base with respect to each other. Thus, the light emitted by the UV light sources on the carrier plate can be refracted so as to reach all the foodstuffs in the compartment. The compartment further comprises a wire shelf for ensuring that the foodstuffs are not placed onto the elevations in a manner to prevent the refraction of the glass. The wire shelf is in the form of a grill so as not to cover the elevations on the reflector.

[0018] In the refrigerator of the present invention, the UV light source is a U-shaped fluorescent lamp or a flat fluorescent lamp. A voltage converter is used to operate the light sources. The power supplied by the control unit of the refrigerator is transmitted from said voltage converter to the UV light sources.

[0019] By means of the present invention, a refrigerator is realized, wherein the UV rays are enabled to reach all the foodstuffs in the compartment and all the surfaces of a foodstuff, thus providing disinfection at the maximum

level.

[0020] The refrigerator 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 the refrigerator of the present invention.

Figure 2 - is the perspective view of the body where the compartment illuminated by the UV light source is removed in the refrigerator of the present invention.

Figure 3 - is the exploded view of the carrier plate, the top plate, the reflector and the UV light sources placed between the compartment and the shelf in the refrigerator of the present invention.

Figure 4 - is the exploded view of the retainer, the UV light source and the quartz glass disposed in the housing in the refrigerator of the present invention.

Figure 5 - is the exploded view of the components disposed in the compartment in the refrigerator of the present invention.

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

1. Refrigerator
2. Body
3. Compartment
4. Shelf
5. UV light source
6. Carrier plate
7. Holder
8. Housing
9. Reflector
10. Wire shelf
11. Top plate
12. Quartz glass
13. Elevation
14. Elastic member

[0022] The refrigerator (1) comprises a body (2); a compartment (3) which is disposed in the body (2) and wherein the foodstuffs are placed; a shelf (4) which is disposed in the body (2); and at least one UV light source (5) which is positioned so as to emit light into the compartment (3).

[0023] The refrigerator (1) of the present invention comprises a carrier plate (6) having a housing (8) wherein the at least one UV light source (5) is placed so as to emit light into the compartment (3) in an angled manner.

[0024] The refrigerator (1) of the present invention comprises at least one UV light source (5) which provides the disinfection of the foodstuffs placed into the compartment (3). A carrier plate (6) is placed between the compartment (3) and the shelf (4) such that the rays emitted by said UV light sources (5) reach all the surfaces in the compartment (3). The carrier plate (6) comprises at least one housing (8) thereon wherein the UV light source (5)

is placed so as to emit light onto the base of the compartment (3) in an angled manner. The carrier plate (6) has a thickness suitable for comprising a housing (8) deep enough to place the UV light sources (5) therein, and comprises a planar surface in the form of a table. On said planar surface, at least one housing (8) is provided which enables the light to be transmitted onto the base of the compartment (3) in an angled manner and which is parallel with the base of the compartment (3). Moreover, on the long or short sides of the carrier plate (6), there are surfaces which are angled with respect to the planar surface of the carrier plate (6) and which are not parallel with the base of the compartment (3). The UV light source (5) is placed into the at least one housing (8) formed on said angled surfaces so as to emit light into the compartment (3) at a non-perpendicular angle. Thus, by means of the UV light source (5) which is placed on the carrier plate (6) so as to emit light at a right angle and the UV light source (5) which is placed onto the carrier plate (6) in an angled manner, an equal amount of UV rays is enabled to reach all the parts of the compartment (3).

[0025] In an embodiment of the present invention, the refrigerator (1) comprises a holder (7) which comprises at least one reflective material selected from among Teflon, aluminum, magnesium, calcium carbonate, silicon or zirconium dioxide so as to efficiently reflect the UV rays into the compartment (3) and which enables the UV light source (5) to be mounted into the housing (8). Thus, the UV light source (5) can be more easily mounted into the housing (8), and by means of the reflective materials of the holder (7), the UV rays are enabled to be efficiently reflected into the compartment (3).

[0026] In an embodiment of the present invention, the refrigerator (1) comprises a holder (7) and/or housing (8) which is coated with at least one reflective material selected from among Teflon, aluminum, magnesium, calcium carbonate, silicon or zirconium dioxide. In said embodiment, even if the housing (8) and/or the holder (7) is produced from any plastic material, a coating with reflective materials is applied such that the UV rays are enabled to be suffused.

[0027] In an embodiment of the present invention, the refrigerator (1) comprises a reflector (9) having a plurality of elevations (13) for refracting the UV light so as to be transmitted to all the surfaces of the foodstuffs in the compartment (3), and a wire shelf (10) which enables the foodstuffs to be placed so as not to cover the elevations (13) and which is placed onto the reflector (9). Thus, the UV rays coming from the carrier plate (6) to the compartment (3) hit the elevations (13) on the reflector (9) to be refracted and suffuse into the compartment (3). Moreover, by means of the wire shelf (10) placed onto the reflector (9), the foodstuffs are prevented from being placed so as to cover the elevations (13) and the UV rays are enabled to reach the underside of the foodstuffs placed into the compartment (3).

[0028] In an embodiment of the present invention, the

refrigerator (1) comprises the reflector (9) having the circular and/or polygonal elevations (13) which are successively arranged in vertical and horizontal rows. Thus, the elevations (13) on the reflector (9) are enabled to better refract and reflect the light.

[0029] In an embodiment of the present invention, the refrigerator (1) comprises a metal top plate (11) which is placed between the compartment (3) and the carrier plate (6) and which protects the carrier plate (6) against the UV rays so as to prevent the same from being damaged. The top plate (11) prevents the rays reflected from the reflector (9) from damaging the material of the carrier plate (6).

[0030] In an embodiment of the present invention, the refrigerator (1) comprises a quartz glass (12) which closes the housing (8) and/or the holder (7) so as to cover the UV light source (5), and an elastic member (14) which is placed between the quartz glass (12) and the housing (8) and/or the holder (7). Thus, a possible impact to the UV light sources (5) is dampened, and the user is prevented from reaching the housing (8) wherein the UV light sources (5) are placed and from being hurt.

[0031] By means of the present invention, a refrigerator (1) is realized, wherein in a compartment in which foodstuffs are placed the light emitted by the UV light sources (5) is enabled to reach all the foodstuffs and all the surfaces of a foodstuff in the compartment (3), thus providing a sterilization process at maximum efficiency.

elevations (13) for refracting the UV light so as to be transmitted to all the surfaces of the foodstuffs in the compartment (3), and a wire shelf (10) which enables the foodstuffs to be placed so as not to cover the elevations (13) and which is placed onto the reflector (9).

5. A refrigerator (1) as in Claim 4, **characterized by** the reflector (9) having the circular and/or polygonal elevations (13) which are successively arranged in vertical and horizontal rows.
6. A refrigerator (1) as in any one of the above claims, **characterized by** a metal top plate (11) which is placed between the compartment (3) and the carrier plate (6) and which protects the carrier plate (6) against the UV rays so as to prevent the same from being damaged.
7. A refrigerator (1) as in any one of the above claims, **characterized by** a quartz glass (12) which closes the housing (8) and/or the holder (7) so as to cover the UV light source (5), and an elastic member (14) which is placed between the quartz glass (12) and the housing (8) and/or the holder (7).

Claims

1. A refrigerator (1) **comprising** a body (2); a compartment (3) which is disposed in the body (2) and wherein the foodstuffs are placed; a shelf (4) which is disposed in the body (2); and at least one UV light source (5) which is positioned so as to emit light into the compartment (3), **characterized by** a carrier plate (6) having a housing (8) wherein the at least one UV light source (5) is placed so as to emit light into the compartment (3) in an angled manner.
2. A refrigerator (1) as in Claim 1, **characterized by** a holder (7) which comprises at least one reflective material selected from among Teflon, aluminum, magnesium, calcium carbonate, silicon or zirconium dioxide so as to efficiently reflect the UV rays into the compartment (3) and which enables the UV light source (5) to be mounted into the housing (8).
3. A refrigerator (1) as in Claim 2, **characterized by** a holder (7) and/or housing (8) which is coated with at least one reflective material selected from among Teflon, aluminum, magnesium, calcium carbonate, silicon or zirconium dioxide.
4. A refrigerator (1) as in any one of the above claims, **characterized by** a reflector (9) having a plurality of

Figure 1

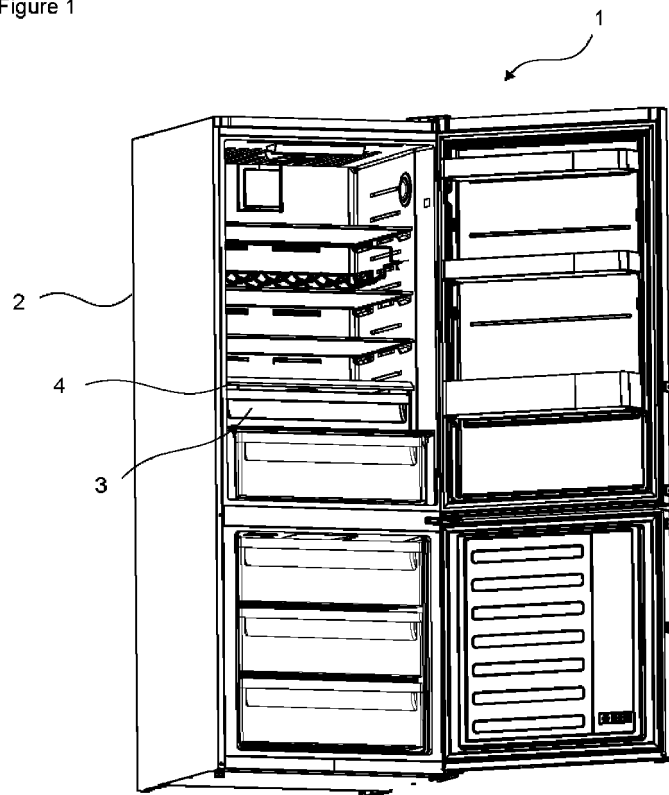


Figure 2

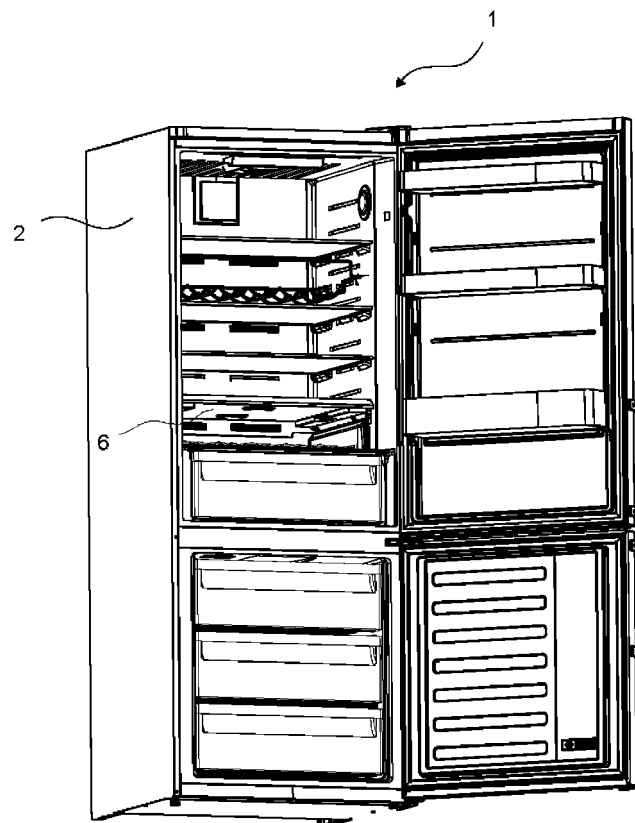


Figure 3

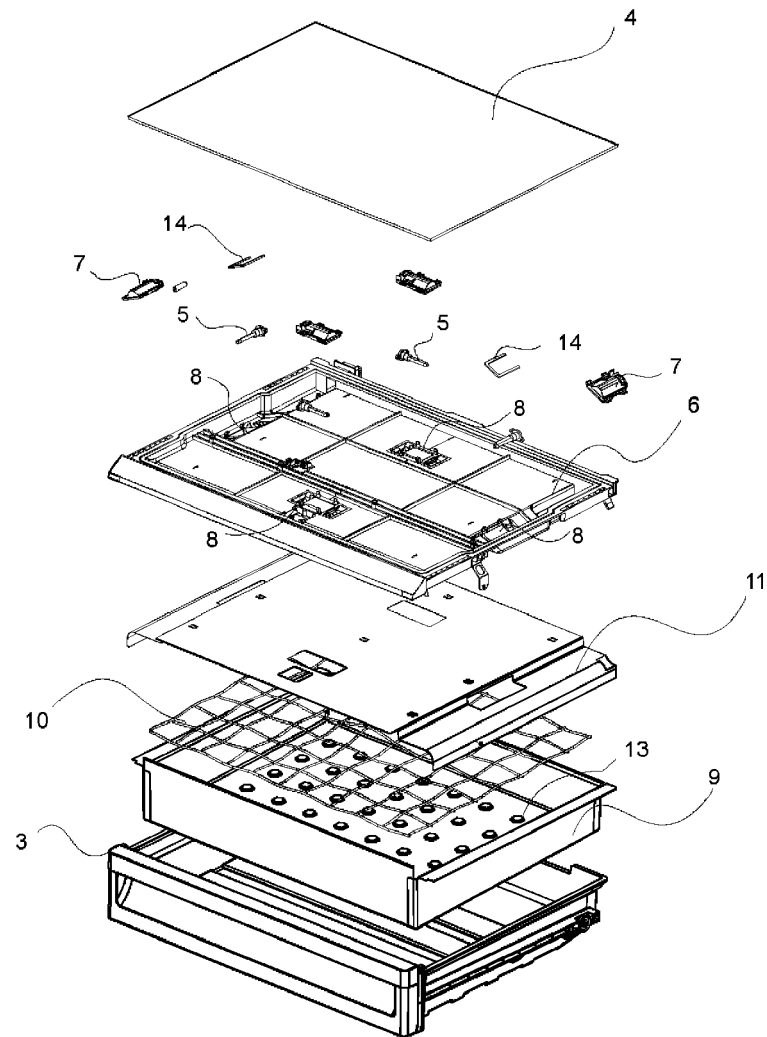


Figure 4

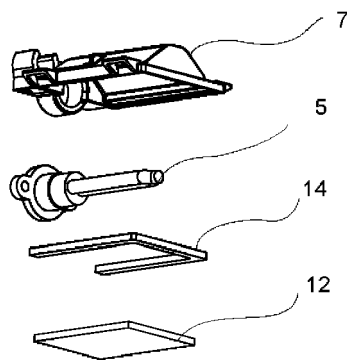
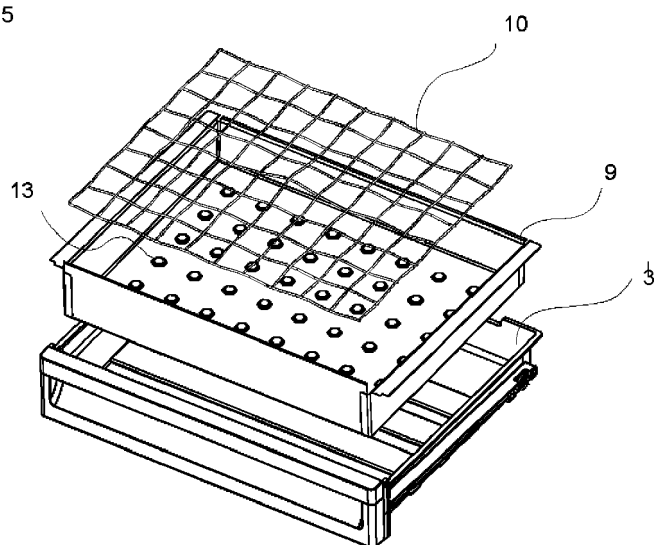


Figure 5





EUROPEAN SEARCH REPORT

 Application Number
EP 21 17 1568

5

10

15

20

25

30

35

40

45

1

50

55

EPO FORM 1503 03.82 (P04C01)

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	JP 6 706733 B2 (PANASONIC IP MAN CORP) 10 June 2020 (2020-06-10)	1	INV. F25D17/04 F25D25/02
Y	* paragraphs [0035], [0037], [0042],	2-6	
A	[0043], [0045]; figures 1-11 *	7	
X	CN 100 575 836 C (LG ELECTRONICS INC) 30 December 2009 (2009-12-30) * page 18, paragraph 5-7; figures 1-5 *	1,7	
X	US 5 253 488 A (KIM KYONG M [KR] ET AL) 19 October 1993 (1993-10-19) * column 2, line 52 - column 3, line 22; figures 1,2 *	1	
X	US 2013/104579 A1 (ZHOU LING [US]) 2 May 2013 (2013-05-02)	1	
Y	* paragraphs [0017], [0023], [0026], [0027]; figures 2,5 *	2,3	
Y	KR 2006 0107040 A (LG ELECTRONICS INC [KR]) 13 October 2006 (2006-10-13) * figure 4 *	4,5	TECHNICAL FIELDS SEARCHED (IPC)
Y	JP 2007 003174 A (MATSUSHITA ELECTRIC IND CO LTD) 11 January 2007 (2007-01-11) * paragraphs [0092], [0093]; figures 1-5 *	6	F25D
X	CN 106 839 585 A (QINGDAO HAIER CO LTD) 13 June 2017 (2017-06-13) * figures 1-4 *	1	
A	US 2015/165079 A1 (SHUR MICHAEL [US] ET AL) 18 June 2015 (2015-06-18) * paragraphs [0066], [0067]; figures 5,6 *	1-7	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 September 2021	Examiner Fest, Gilles
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	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 17 1568

5

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.

30-09-2021

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 6706733 B2	10-06-2020	JP 6706733 B2	10-06-2020
		JP 2017172905 A	28-09-2017
CN 100575836 C	30-12-2009	CN 101322000 A	10-12-2008
		KR 20070045482 A	02-05-2007
US 5253488 A	19-10-1993	JP H05180555 A	23-07-1993
		KR 930000921 A	16-01-1993
		US 5253488 A	19-10-1993
US 2013104579 A1	02-05-2013	EP 2773384 A1	10-09-2014
		US 2013104579 A1	02-05-2013
		WO 2013066807 A1	10-05-2013
KR 20060107040 A	13-10-2006	NONE	
JP 2007003174 A	11-01-2007	NONE	
CN 106839585 A	13-06-2017	NONE	
US 2015165079 A1	18-06-2015	NONE	

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

- KR 20050026739 [0004]
- EP 2525173 B1 [0005]