

(19)



(11)

EP 3 926 265 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:

02.08.2023 Bulletin 2023/31

(51) International Patent Classification (IPC):

F25D 17/04 ^(2006.01) **F25D 25/02** ^(2006.01)

(52) Cooperative Patent Classification (CPC):

F25D 17/042; F25D 25/025; F25D 2317/0417

(21) Application number: **21171568.5**

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

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

KÜHLSCHRANK MIT EINER UV-LICHTQUELLE

RÉFRIGÉRATEUR COMPRENANT UNE SOURCE DE LUMIÈRE UV

(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

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

(43) Date of publication of application:

22.12.2021 Bulletin 2021/51

(73) Proprietor: **Arçelik Anonim Şirketi**

34445 Istanbul (TR)

(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)

(56) References cited:

CN-A- 106 839 585

CN-C- 100 575 836

JP-A- 2002 350 040

JP-A- 2007 003 174

JP-B2- 6 706 733

KR-A- 20060 107 040

US-A- 5 253 488

US-A1- 2013 104 579

US-A1- 2015 165 079

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

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 state of the art Japan Patent Document No. JP6706733 relates to a refrigerator having a low-temperature storage compartment inside the refrigerating compartment.

[0007] The state of the art Chinese Patent Document No. CN101322000 relates to a refrigerator, and more particularly, to a refrigerator capable of storing vegetables and fruits or meat and fish in a fresher state.

[0008] The state of the art United States Patent Document No. US5253488 relates to a vegetable storage drawer of a refrigerator which has an absorbing apparatus positioned in the storage drawer for absorbing a noxious gas generated from vegetables and for preserving vegetables for a long period of time.

[0009] The state of the art United States Patent Document No. US2013104579 relates to a refrigerator including ultraviolet light emitting diodes.

[0010] The state of the art Korea Patent Document No. KR20060107040 relates to a defrosting unit of a refrigerator, and more particularly, to a defrosting unit and a defrosting chamber of a refrigerator for defrosting frozen food using radiant heat generated by a heating element.

[0011] The state of the art Japan Patent Document No. JP2007003174 relates to refrigerators with storage compartments made more durable by means of LEDs with wavelengths in the ultraviolet region.

[0012] The state of the art Japan Patent Document No. JP2002350040 relates to a refrigerator in which a storage

chamber and a duct are defined within a heat-insulating box body, and cool air exchanged with a cooler disposed in the duct is circulated in the storage chamber by a blower.

[0013] 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.

[0014] This aim is achieved by a refrigerator according to independent claim 1. 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] The thickness of the coating is between 0.1 micron and 5 mm, and the coating is carried out preferably by anodized coating method.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] Voltage converters are provided in the compartment to operate the UV light sources.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] 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

[0029] 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).

[0030] 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.

[0031] 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). Moreo-

ver, 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).

[0032] 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).

[0033] 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.

[0034] According to 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).

[0035] 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.

[0036] 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).

[0037] 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.

[0038] 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.

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); a carrier plate (6) placed between the compartment (3) and the shelf (4) and having a planar surface and at least one surface on the long or short sides of the carrier plate (6) which is angled with respect to the planar surface and which is not parallel with the base of the compartment (3), at least one housing (8) which is placed on the planar surface as parallel with the base of the compartment (3), wherein at least one UV light source is placed into the housing on the planar surface, so as to emit light into the compartment at a right angle **characterized in that** the refrigerator further comprises

- at least another housing (8) which is placed on the at least one angled surface, wherein at least another UV light source is placed into the housing on the angled surface, so as to emit light into the compartment at a non-perpendicular angle,
- a reflector (9) placed in the compartment, wherein the reflector (9) has 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).

2. A refrigerator (1) as in Claim 1, **characterized by** holders (7) which comprise 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 enable each UV light source (5) to be mounted into each housing (8).

3. A refrigerator (1) as in Claim 2, **characterized by** each holder (7) and/or each 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 Claim 1, **characterized by** the reflector (9) having the circular and/or polygonal elevations (13) which are successively arranged in vertical and horizontal rows.
5. 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.
6. A refrigerator (1) as in any one of the above claims, **characterized by** a quartz

glass (12) which closes each housing (8) and/or each 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 each housing (8) and/or each holder (7).

Patentansprüche

1. Ein Kühlschrank (1) umfasst einen Körper (2); ein Fach (3), das im Körper (2) angeordnet ist und in dem die Lebensmittel untergebracht sind; ein Regal (4), das im Körper (2) angeordnet ist; eine Trägerplatte (6), die zwischen dem Fach (3) und dem Regal (4) platziert ist und eine ebene Oberfläche und mindestens eine Oberfläche an den langen oder kurzen Seiten der Trägerplatte (6) aufweist, der gegenüber der ebenen Fläche abgewinkelt ist und nicht parallel zum Boden des Fachs (3) verläuft, mindestens ein Gehäuse (8), das auf der ebenen Fläche parallel zum Boden des Fachs (3) platziert ist, wobei mindestens eine UV-Lichtquelle im Gehäuse auf der ebenen Oberfläche platziert ist, um Licht in einem rechten Winkel in das Fach zu emittieren, gekennzeichnet ist es dadurch, dass der Kühlschrank weiterhin Folgendes umfasst:

- mindestens ein weiteres Gehäuse (8), das auf der mindestens einen abgewinkelten Fläche platziert ist, wobei mindestens eine weitere UV-Lichtquelle im Gehäuse auf der abgewinkelten Fläche platziert ist, um Licht in einem nicht senkrechten Winkel in das Fach zu emittieren,

- einen im Fach platzierten Reflektor (9), wobei der Reflektor (9) mehrere Erhebungen (13) zur Brechung des UV-Lichts aufweist, so dass es auf alle Oberflächen der Lebensmittel im Fach (3) übertragen wird, und einen Gitterrost (10), der es ermöglicht, dass die Lebensmittel so platziert werden können, dass die Erhebungen (13) nicht abgedeckt werden, und der auf den Reflektor (9) aufgesetzt wird.

2. Ein Kühlschrank (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** Halterungen (7) mindestens ein reflektierendes Material umfassen, ausgewählt aus Teflon, Aluminium, Magnesium, Calciumcarbonat, Silizium oder Zirkoniumdioxid, um die UV-Strahlen effizient in das Fach (3) zu reflektieren und die die Montage jeder UV-Lichtquelle (5) in jedem Gehäuse (8) ermöglichen.
3. Ein Kühlschrank (1), wie in Anspruch 2 aufgeführt, **ist dadurch gekennzeichnet, dass** jeder Halter (7) und/oder jedes Gehäuse (8) mit mindestens einem reflektierenden Material beschichtet ist, ausgewählt aus Teflon, Aluminium, Magnesium, Calciumcarbonat, Silizium oder Zirkoniumdioxid.
4. Ein Kühlschrank (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** der Reflektor (9) kreisförmige und/oder vieleckige Erhebungen (13) aufweist, die nacheinander in vertikalen und horizontalen Reihen angeordnet sind.
5. Ein Kühlschrank (1), wie in einem der vorherigen Ansprüche aufgeführt, **ist dadurch gekennzeichnet, dass** eine metallische Deckplatte (11) zwischen dem Fach (3) und der Trägerplatte (6) angeordnet ist und die Trägerplatte (6) vor UV-Strahlen schützt, um eine Beschädigung derselben zu verhindern.
6. Ein Kühlschrank (1), wie in einem der vorherigen Ansprüche aufgeführt, **ist dadurch gekennzeichnet, dass** ein Quarzglas (12), das jedes Gehäuse (8) und/oder jede Halterung (7) so abschließt, um die UV-Lichtquelle (5) abzudecken, und ein elastisches Element (14), das zwischen dem Quarzglas (12) und jedem Gehäuse (8) und/oder jedem Halter (7) angeordnet ist.

Revendications

1. Un réfrigérateur (1) **comprenant** un corps (2) ; un compartiment (3) disposé dans le corps (2) et dans lequel sont placés les aliments ; une étagère (4) disposée dans le corps (2) ; une plaque de support (6) placée entre le compartiment (3) et l'étagère (4) et présentant une surface plane et au moins une surface sur les côtés longs ou courts de la plaque de

support (6) qui est inclinée par rapport à la surface plane et qui n'est pas parallèle à la base du compartiment (3), au moins un boîtier (8) placé sur la surface plane parallèlement à la base du compartiment (3), dans lequel au moins une source de lumière UV est placée dans le boîtier sur la surface plane, de manière à émettre de la lumière dans le compartiment à un angle droit **caractérisé par le fait que** le réfrigérateur comprend en outre

5

10

- au moins un autre boîtier (8) placé sur au moins une surface inclinée, dans lequel au moins une autre source de lumière UV est placée dans le boîtier sur la surface inclinée, de manière à émettre de la lumière dans le compartiment à un angle non perpendiculaire,
- un réflecteur (9) placé dans le compartiment, dans lequel le réflecteur (9) présente une pluralité d'élévations (13) pour réfracter la lumière UV afin qu'elle soit transmise à toutes les surfaces des denrées alimentaires dans le compartiment (3), et une étagère en fil métallique (10) qui permet de placer les denrées alimentaires de manière à ne pas couvrir les élévations (13) et qui est placée sur le réflecteur (9).

15

20

25

2. Un réfrigérateur (1) selon la déclaration 1, **caractérisé par** des supports (7) qui comprennent au moins un matériau réfléchissant choisi parmi le téflon, l'aluminium, le magnésium, le carbonate de calcium, le silicium ou le dioxyde de zirconium de manière à réfléchir efficacement les rayons UV dans le compartiment (3) et qui permettent à chaque source de lumière UV (5) d'être montée dans chaque boîtier (8).
3. Un réfrigérateur (1) tel que dans la déclaration 2, **caractérisé par** chaque support (7) et/ou chaque boîtier (8) qui est revêtu d'au moins un matériau réfléchissant choisi parmi le téflon, l'aluminium, le magnésium, le carbonate de calcium, le silicium ou le dioxyde de zirconium.
4. Un réfrigérateur (1) selon la déclaration 1, **caractérisé par le fait que** le réflecteur (9) présente des élévations circulaires et/ou polygonales (13) qui sont disposées successivement en rangées verticales et horizontales.
5. Un réfrigérateur (1) selon l'une quelconque des déclarations ci-dessus, **caractérisé par** une plaque supérieure métallique (11) qui est placée entre le compartiment (3) et la plaque de support (6) et qui protège la plaque de support (6) contre les rayons UV afin d'éviter qu'elle ne soit endommagée.
6. Un réfrigérateur (1) selon l'une quelconque des déclarations précédentes, **caractérisé par** un verre de

30

35

40

45

50

55

quartz (12) qui ferme chaque boîtier (8) et/ou chaque support (7) de manière à couvrir la source de lumière UV (5), et un élément élastique (14) qui est placé entre le verre de quartz (12) et chaque boîtier (8) et/ou chaque support (7).

Figure 1

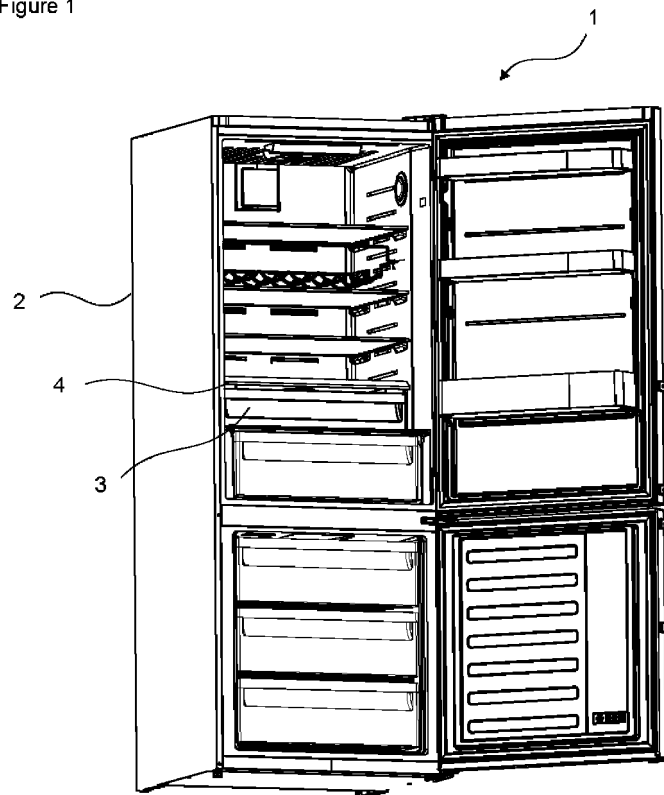


Figure 2

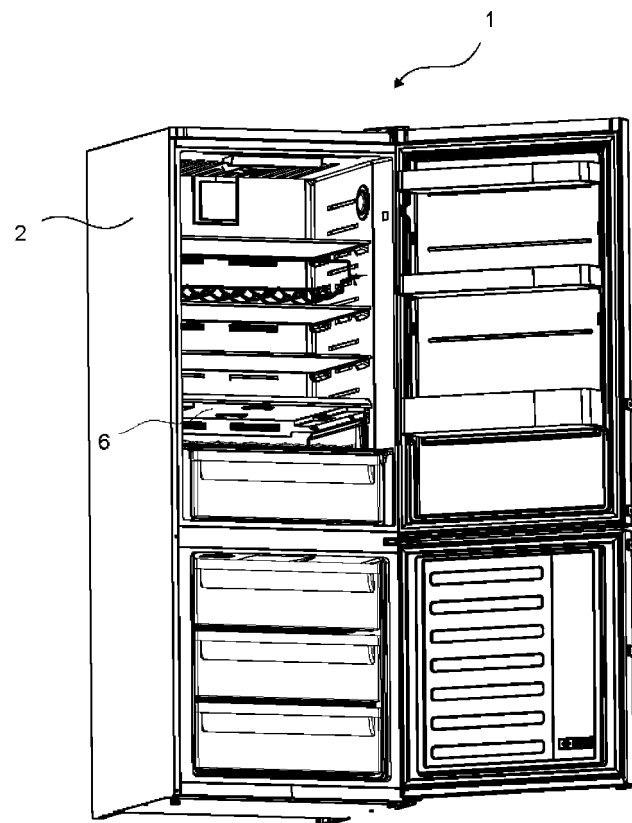


Figure 3

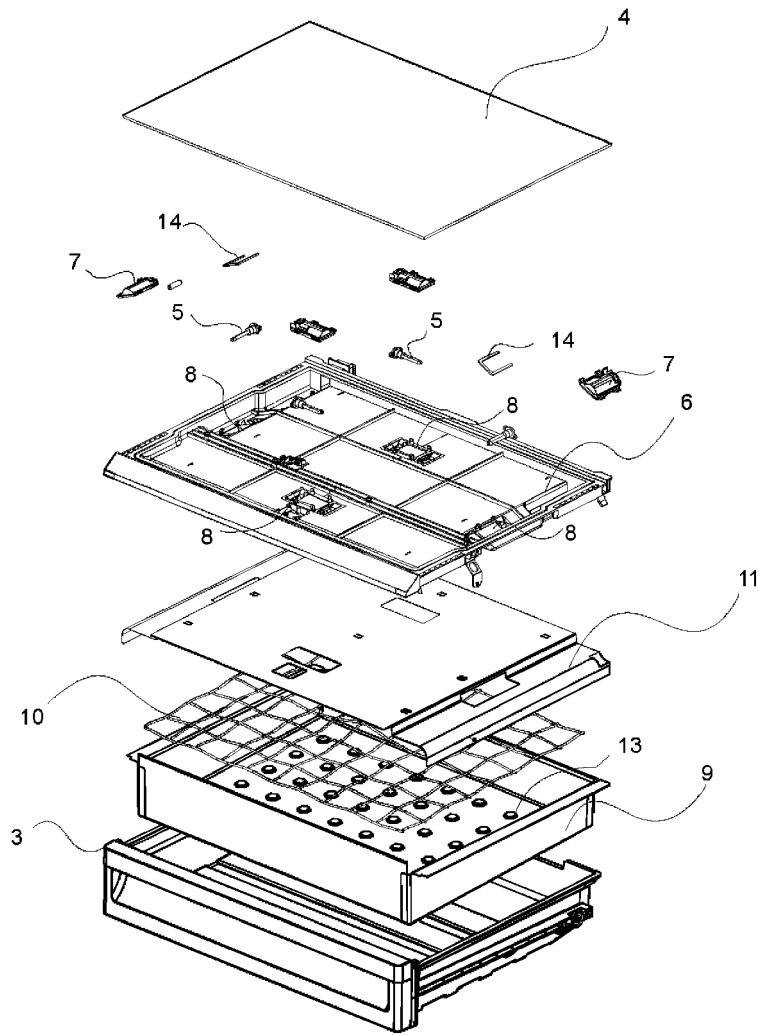


Figure 4

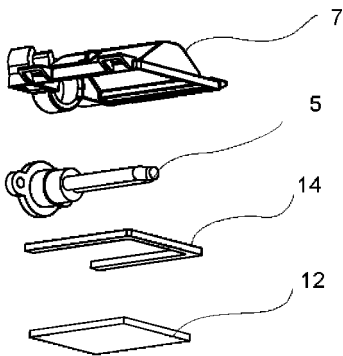
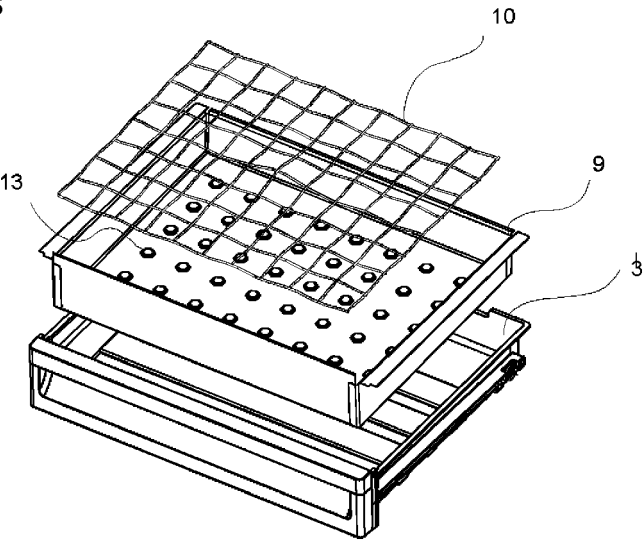


Figure 5



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]
- JP 6706733 B [0006]
- CN 101322000 [0007]
- US 5253488 A [0008]
- US 2013104579 A [0009]
- KR 20060107040 [0010]
- JP 2007003174 B [0011]
- JP 2002350040 B [0012]