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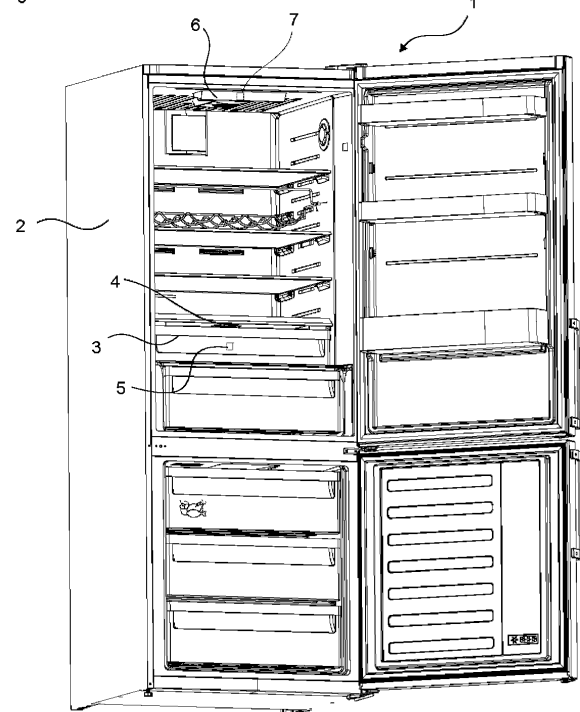
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(54) **A SMART REFRIGERATOR COMPRISING A UV LIGHT SOURCE**

(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; and at least one UV light source (4) which is disposed in the compartment (3) and which sterilizes the foodstuffs loaded into the compartment (3), wherein the refrigerator further comprises a control unit which controls the operational parameters of the UV light source such as intensity, time, etc., and a wireless communication module which communicates with the control unit so as to convey the operational parameters of the sterilization process of the UV light source to the user via a mobile device.

Figure 1



Description

[0001] The present invention relates to a refrigerator comprising a compartment having a UV light source wherein the suitable time and operation conditions for the sterilization of the foodstuffs placed therein are adjusted.

[0002] There may be 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. In said cooling devices, when the door of the cooling device is closed, the UV light source is continuously operated to destroy the harmful microorganisms and substances and sterilize the foodstuffs.

[0004] In the state of the United States Patent Document No. US5901564A, a refrigerator is disclosed, comprising a control unit which is activated when the door of the refrigerator is closed and which actuates the operation of the UV light source.

[0005] In the state of the art Chinese Utility Model Document No. CN208821659U, a refrigerator is disclosed, wherein the control unit automatically adjusts the start and stop times of the UV LED light source.

[0006] In any one of the above state of the art documents, there is no disclosure of a smart refrigerator wherein the operation time of the UV light source, the intensity of the UV light source and/or the operation intervals are controlled by the user.

[0007] The aim of the present invention is the realization of a smart refrigerator comprising a UV light source the operational status and parameters can be conveyed to the user and the operation time, the light intensity and/or the operation intervals of which can be controlled depending on the sterilization needs of the user.

[0008] The UV light source used in the smart refrigerator of the present invention is one of the UVA, UVB or UVC fluorescent lamp or UV LED light.

[0009] In an embodiment of the smart refrigerator of the present invention, on a table in the compartment, a total of four UV light sources are provided, two light sources being positioned at the center of the opposite long sides and two UV light sources positioned in an angled manner at the center of the short sides so as to reach a plurality of points in the compartment.

[0010] The housings wherein the UV light sources are placed are covered with a quartz glass.

[0011] The refrigerator of the present invention comprises a wireless communication module which enables the simple process data kept in the control unit such as the operational status, operation time and light intensity of the UV light source to be conveyed to the user.

prises a wireless communication module which enables the simple process data kept in the control unit such as the operational status, operation time and light intensity of the UV light source to be conveyed to the user.

[0012] In the refrigerator of the present invention, the control unit contains the suitable UV light intensity and UV operation time for providing the optimum foodstuff sterilization predetermined by the producer. In the normal operation cycle, the foodstuff sterilization process is performed with an ultraviolet light radiation at 180-280 nm for 20 minutes with user intervention. However, if desired to use the refrigerator in an interactive manner, the user may need to operate the UV light source for a shorter or longer time or at a less or more intensity as per his/her preference. In this case, the user can customize the operational conditions and send commands to the control unit via the wireless communication module by means of the mobile device. Thus, the disinfection process is carried out as per the personal needs of the users.

[0013] The UV light sources in the refrigerator of the present invention emit light at a wavelength between 180 and 280 nm, preferably 254 nm for optimum disinfection. The user can adjust the intensity of the UV light source by changing the amplitude of the light source at a wavelength between 180 and 280 nm predetermined by the producer as per his/her needs.

[0014] Moreover, in the refrigerator of the present invention, the data such as the active time of the UV light source, the activation time thereof, the deactivation time thereof and the wavelength of the emitted UV light can be transmitted to the mobile device via the wireless communication module. Thus, the operation of the UV light source which is required for the sterilization of the foodstuffs, but which is unfavorable for the exposure of the user in cases such as when the door is open, etc. can be safely realized under the control and within the knowledge of the user.

[0015] An internal or external antenna is provided on the wireless communication module.

[0016] In an embodiment of the present invention, the selections made by the user, which are stored in the control unit are daily, hourly and weekly transmitted to a server via the wireless communication module so as to measure the behavioral tendencies of the user. The information stored in the server is analyzed so as to determine the habits of the user. For example, the control unit determines that the user shops in Tuesdays and the compartment becomes full in the same day, and stores the related information in the server. Thus, the refrigerator informs the user to operate the UV light source longer in Tuesdays than other days via the mobile device.

[0017] In this embodiment of the present invention, there is a door sensor (magnet, induction switch, etc.) which detects the opening/closing times of the door and how long the door is left open in order to measure the behavior of the user and/or a weight, distance sensor which detects the loading of the foodstuffs in the compartment, and an imaging unit.

[0018] By means of the present invention, a smart refrigerator is realized, wherein the user can adjust the UV light sources as active or passive as per his/her personal needs and control the operation time and ultraviolet light intensity.

[0019] 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 a schematic showing the communication relation among the control unit, the wireless communication module, the mobile device and the server in the refrigerator of the present invention.

[0020] The elements illustrated in the figures are numbered as follows:

1. Refrigerator
2. Body
3. Compartment
4. UV light source
5. Sensor
6. Control unit
7. Wireless communication module
8. Mobile device
9. Server

[0021] The refrigerator (1) comprises a body (2); a compartment (3) which is disposed in the body (2) and wherein the foodstuffs are placed; and at least one UV light source (4) which is disposed in the compartment (3) and which sterilizes the foodstuffs loaded into the compartment (3).

[0022] The refrigerator (1) of the present invention comprises a control unit (6) which controls the operational parameters of the UV light source (4) such as intensity, time, etc., and a wireless communication module (7) which communicates with the control unit (6) so as to convey the operational parameters of the sterilization process of the UV light source (4) to the user via a mobile device (8).

[0023] The refrigerator (1) of the present invention comprises at least one UV light source (4) in a compartment (3) wherein the foodstuffs are placed. The UV light source (4) emits a light at the ultraviolet wavelength and sterilizes the foodstuffs. The control unit (6) contains data related to the activation time of the UV light source (4), the operation time thereof, the intensity of the light, the stopping of the operation or the malfunction of the light source (4) in case of a possible problem. The operational data related to the UV light source (4) in the control unit (6) is conveyed to the user via a mobile device (8) by means of a wireless communication module (7). Thus, the user can be informed of how long the foodstuffs in the compartment (3) are subjected to the ultraviolet light at what intensity, and can control the UV light source (4).

Moreover, the user is informed of the failure to sterilize the foodstuffs in case of the malfunction of the UV light source (4), and the foodstuff sterilization process can be efficiently managed thanks to an interactive communication with the user.

[0024] In an embodiment of the present invention, the refrigerator (1) comprises a wireless communication module (7) which enables the user to activate or deactivate the UV light source (4) and to adjust the operational parameters of the UV light source (4) as per his/her preference, and which transmits the user selections to the control unit (6) via a mobile device (8). Thus, the user can adjust the operational parameters of the UV light source (4) as per his/her cleaning needs.

[0025] In an embodiment of the present invention, the refrigerator (1) comprises a sensor (5) which measures the weight so as to detect the amount of the foodstuffs in the compartment (3), and a control unit (6) which, according to the data received from the sensor (5), warns the user if the fullness rate of the compartment (3) reaches a level predetermined by the producer which will prevent the efficient operation of the UV light source (4). Thus, the UV light source (4) is enabled to reach and sterilize all the foodstuffs loaded into the compartment (3). When an amount of foodstuff which will affect the efficient operation of the UV light source (4) is loaded into the compartment (3), the user is informed, thus ensuring proper foodstuff sterilization and ensuring the user safety.

[0026] In an embodiment of the present invention, the refrigerator (1) comprises at least one sensor (5) which measures the distance and which is disposed in the vicinity of the UV light source (4), and a control unit (6) which, according to the data received from the sensor (5), warns the user if the fullness rate of the compartment (3) reaches a level predetermined by the producer which will prevent the efficient operation of the UV light source (4). Thus, the UV light source (4) is enabled to reach and sterilize all the foodstuffs loaded into the compartment (3).

[0027] In an embodiment of the present invention, the refrigerator (1) comprises a control unit (6) which records the past selections of the user in the UV sterilization process by means of a server (9) in communication with the wireless communication module (7), which determines the disinfection needs of the user by analyzing the past selections, and which guides the user via the mobile device (8). In said embodiment, the hourly, daily and weekly past selections of the user are transmitted to the control unit (6) and to the server (9) by means of the wireless communication module (7) so as to be recorded. Thus, a data pool which is large enough to carry out a data analysis is formed. By using the data pool to determine the selections of the user related to the operational status of the UV light source (4), the days when the UV light source (4) is operated the most and the hours in said day when the UV light source (4) is activated at maximum, etc., the user needs are analyzed such that the user can

be guided. Thus, the user is guided so as to efficiently operate the UV light source (4) used for sterilizing the foodstuffs and eliminating the harmful microorganisms.

[0028] By means of the present invention, a smart refrigerator (1) is realized, wherein the user is informed of the operational status of the UV light source (4) and the user is guided through a customized sterilization scenario as per user needs without unnecessary energy consumption.

with the wireless communication module (7), which determines the disinfection needs of the user by analyzing the past selections, and which guides the user via the mobile device (8).

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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; and at least one UV light source (4) which is disposed in the compartment (3) and which sterilizes the foodstuffs loaded into the compartment (3), **characterized by** a control unit (6) which controls the operational parameters of the UV light source (4) such as intensity, time, etc., and a wireless communication module (7) which communicates with the control unit (6) so as to convey the operational parameters of the sterilization process of the UV light source (4) to the user via a mobile device (8). 15
2. A refrigerator (1) as in Claim 1, **characterized by** a wireless communication module (7) which enables the user to activate or deactivate the UV light source (4) and to adjust the operational parameters of the UV light source (4) as per his/her preference, and which transmits the user selections to the control unit (6) via a mobile device (8). 20 25 30
3. A refrigerator (1) as in Claim 1 or 2, **characterized by** a sensor (5) which measures the weight so as to detect the amount of the foodstuffs in the compartment (3), and a control unit (6) which, according to the data received from the sensor (5), warns the user if the fullness rate of the compartment (3) reaches a level predetermined by the producer which will prevent the efficient operation of the UV light source (4). 35 40
4. A refrigerator (1) as in any one of the above claims, **characterized by** at least one sensor (5) which measures the distance and which is disposed in the vicinity of the UV light source (4), and a control unit (6) which, according to the data received from the sensor (5), warns the user if the fullness rate of the compartment (3) reaches a level predetermined by the producer which will prevent the efficient operation of the UV light source (4). 45 50
5. A refrigerator (1) as in any one of the above claims, **characterized by** a control unit (6) which records the past selections of the user in the UV sterilization process by means of a server (9) in communication 55

Figure 1

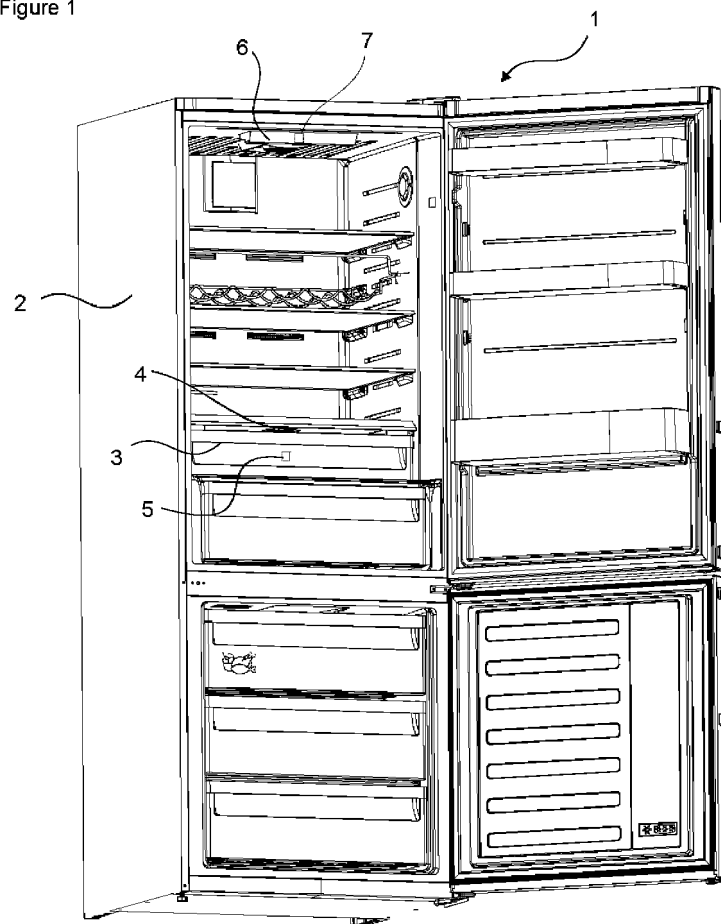
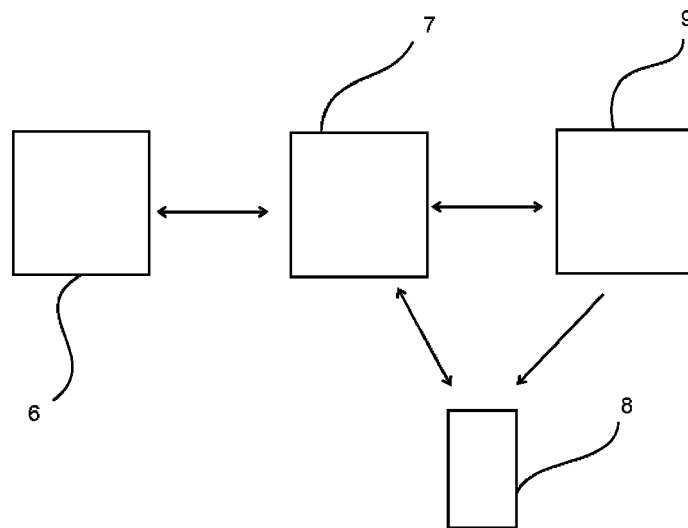


Figure 2





EUROPEAN SEARCH REPORT

Application Number
EP 21 17 6408

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X	US 10 517 976 B2 (SENSOR ELECTRONIC TECH INC [US]) 31 December 2019 (2019-12-31) * column 11, lines 55-66 * * column 13, line 67 - column 14, line 7 * * column 14, lines 25-42 * * column 15, lines 19-49 * * column 16, lines 31-67 * * figures 4,5A *	1,2,5	INV. F25D17/04
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 October 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	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 21 17 6408

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
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29-10-2021

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