



(51) International Patent Classification:
F25D 17/04 (2006.01)

(21) International Application Number:

PCT/TR2013/000080

(22) International Filing Date:

15 March 2013 (15.03.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2012/03023

16 March 2012 (16.03.2012)

TR

(72) Inventors; and

(71) Applicants : **KARABULUT, Ozgur** [TR/TR]; Görükle Kampüsü Uludağ Üniversitesi Ziraat Fakültesi Bitki Koruma Bölümü, Nilüfer, 16059 Bursa (TR). **ILHAN, Kadir** [TR/TR]; Görükle Kampüsü Uludağ Üniversitesi Ziraat Fakültesi Bitki Koruma Bölümü, Nilüfer, 16059 Bursa

(TR). **ŞEHİRLİ, Sercan** [TR/TR]; Görükle Kampüsü Uludağ Üniversitesi Ziraat Fakültesi Bitki Koruma Bölümü, Nilüfer, 16059 Bursa (TR).

(74) Agent: **DESTEK PATENT, INC.**; Konak Mah. Lefkose Cad. NM Ofis Park B Blok No: 36 / 5 Besevler Nilüfer, 16110 Bursa (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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, 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, 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.

[Continued on next page]

(54) Title: REFRIGERATOR

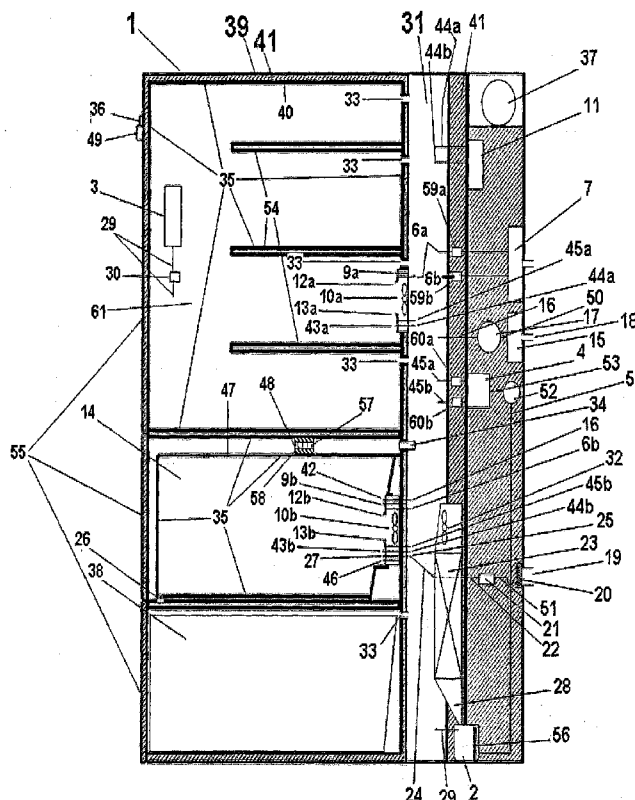


Figure 1

(57) Abstract: The invention is related to the system and application method of raising relative humidity first and then providing ozone gas to the products to be kept inside the refrigerator that has antimicrobial coating material.



(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, 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, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

DESCRIPTION

REFRIGERATOR

Field of Invention

The invention is related to an application model facilitating the disinfection and sterilization inside a refrigerator that is heat insulated and has a leak-proof body.

The invention is particularly related to an application model enabling to ozone application at different doses and durations after interaction with high relative humidity of such products stored in refrigerator on the surfaces with a coating material of antimicrobial effect. In addition, it is also related to the application model enabling to prevent decaying of products due to pathological and physiological reasons, and to preservation the same for longer periods and in much healthier way.

Background of Invention

As known, vegetables and fruit are living organisms. Even after harvesting products, they are in interaction with numerous different factors and agents as they are in field conditions. Such agents and factors may be summarized shortly as light, humidity, heat, microorganisms and environmental gases. As result of such impacts, products quickly start getting old and losing water. In addition, sensitivity of products to pathological agents and physiological factors increases. As result of all these, storage times of products get shorter.

In the state of art, there are various applications dealing with the issue. There are many applications and patents made for lengthening storage times of products. Among such application concerning particularly with refrigerators, there are such patents with the purpose of ozone application at high humidity levels; impact of antimicrobial-coated surfaces on pathogen sterilization; pathogen eliminations by making use of sources emitting lights with different wavelengths.

Those patents, the names and numbers thereof and sample numbers that were come across during the literature search conducted in the state of art regarding the issue are given in the below table.

Table 1. Patent names and patent numbers come across as result of literature search conducted in the state of art concerning the issue.

Sample Number	Name of Relevant Patent	Number of Relevant Patent
1	Refrigerator	US2010/0223944 A1
2	Refrigerator	JP2009109175 (A)
3	Device and Method Enabling Sanitation of Various Objects with Ozone	US2003/0156978 A1
4	Refrigerator	JP2002/156182 (A)

5	Refrigerator	JP2008/089203 (A)
6	Refrigerator	JP2009/109175 (A)
7	Refrigerator	EP2141427 (A1)
8	Coating Material and Usage thereof, Having Antimicrobial Compounds	WO2010/057969 (A1)
9	Combining Inorganic Antibacterial Compounds with Flexible Cellular Material and the Usage Areas Thereof	WO0134686 (A2)

One of the patents encountered as result of the literature search conducted in the state of art concerning the issue is the application numbered US2010/0223944 A1 and titled as "Refrigerator"(sample number 1). In the application model recounted in the summary of the invention, it is mentioned of decreasing number of such microorganisms as bacteria, mold, yeast and viruses that may be present on the surfaces of products to be stored in refrigerator and on the inner surfaces of refrigerator and lengthening storage times of products by fogging inside refrigerators with a mixture of ozone gas and humidity as nano-particles. The application model of the said patent is related to spraying using an electrostatic atomizer into refrigerator and vegetable compartment a mixture of humidity particles with very low ozone concentrations obtained from an ozone source combined. In the said application technique, it is stated that by fogging humid ozone particles with each other simultaneously, sterilization is made against to bacteria, mold, yeast and viruses on inner surfaces of refrigerator and on product surfaces.

Another patent application concerning to the issue is the application numbered JP2009109175 (A) and titled as "Refrigerator"(sample number 2). In the summary of said application, ozone gas obtained from ozone source is combined with water in a water channel through a pipe line. Ozone gas not dissolved in water is broken up with ozone gas disintegration system. In the said application model, ozone gas dissolved in water is controlled through a control valve. It mentions of such ozonized water being fogged to refrigerator and vegetable compartments from ultrasonic humidification unit. Said ozonized water particles coming out of said fogging unit is said to make sterilization on vegetables and fruit and on refrigerator surfaces.

Another patent application related to the issue is the application numbered US2003/0156978 A1 and titled as "Device and Method Enabling Sanitation of Various Objects with Ozone" (sample number 3). In the summary of said application is stated that it is possible to make sanitation of all food products with it. Said application model is related to obtaining ozonized water as result of mixing water from a water reservoir with the ozone gas obtained from an ozone source producing ozone gas. In the said application model, with the ozonized water obtained is realized

sanitation of microorganisms harmful on foodstuffs. Moreover, by using the said application model, it is expressed to prevent water loss of foodstuffs. The said application model is to transferring the water from water reservoir with enabled heat control to another water tank wherein water circulation is made. In the said application model, ozone gas and water is gathered in a second circulation tank. The second circulation tank contains ozonized water at high concentrates. Said high concentrate ozonized water is returned to the water tank. Within said water tank, a lower concentration of ozonized water is obtained by diluting with water. In the said application model, fogging at different temperature and humidity levels is possible as well as applying other compounds in combination with such ozonized water.

Another patent application concerning to the issue is the application numbered JP2002/156182 (A) and titled as "Refrigerator" (sample number 4). In the summary of said application model of the invention, it is mentioned of an application model and device enabling to eliminate odors occurring inside refrigerators. In the aforesaid application model, odor elimination consists of a cabinet of two parts having transition to each other. For the first section of such cabinet, it is recounted of obtaining ozone gas at low concentrations via ozone source from humidity occurring inside refrigerator. Such generator provides production of oxygen molecule by snapping off hydrogen ions from humidity in the air inside refrigerator. Such oxygen molecules convert into ozone molecules by passing through a transmission line. Such molecules pass through from the first part into the second part of said device via a channel. Ozone molecules passing through said channel combine with odor occurring from various sources inside refrigerator. Said odor is broken apart using ozone gas. Upon said breaking apart, ozonized air flow of which odor is eliminated is supplied into refrigerator from the second part of said device. During the process of supplying such air, high concentrations of ozone gas are broken apart. Said breaking apart of ozone gas is obtained by ozone gas disintegration unit. Said application model and device expresses elimination of said undesirable odor occurring inside refrigerators.

Another patent application concerning to the issue is the application numbered JP2008/089203 (A) and titled as "Refrigerator" (sample number 5). In the summary of said application model of the invention, it is mentioned to be related to prevention of water loss of products to be stored in refrigerator and to maintaining freshness thereof. In the said application model, water necessity required for maintaining freshness of products is provided by water reservoir. Water supplied from said water reservoir is transmitted via a transmission pipe to ultrasonic humidifier located in refrigerator or vegetable compartment and products to be stored are fogged with humidity. Said application model is related to provision of humidity to products and maintaining freshness thereof.

Another patent application concerning to the issue is the application numbered JP2009/109175 (A) and titled as "Refrigerator" (sample number 6). In the said application model of the invention, it is mentioned to be related to sterilization of bacteria, mold, yeast and viruses on surfaces of

vegetables and fruit and in the air inside refrigerator. In the said application model, there is a unit producing cold air, a fan and an electrostatic atomizer. In the said application model, the cold air circulated reaches to electrostatic atomizer. There are water absorbents around the said electrostatic atomizer. Such water absorbents produce the humidity necessary for fogging with the absorption of humidity occurring inside refrigerator. Said electrostatic atomizer combines the humidity provided by water absorbents with nano-scale ozone particles produced by it. Said atomizer sprays such nano-scale ozone particles combined into refrigerator or vegetable compartments. Said application model means to realize sterilizing bacteria, mold, yeast and viruses on the surfaces of products and inside refrigerator through particles sprayed by said atomizer.

Another patent application concerning to the issue is the application numbered EP2141427 (A1) and titled as "Refrigerator" (sample number 7). In the summary of said application model of the invention, it is said that sterilization of the air inside refrigerator is obtained by a light source, able to produce lights with different wavelengths, and the air passing through such light source via some filters made of different compounds with antimicrobial properties. Said application model is made inside a refrigerator having ventilation channels at different points thereof. Cold air in such refrigerator is conducted to the light source through air transmission channels. Such light source produces an ultraviolet (UV) and blue light between 0-520 nm nm wavelengths. Such light source enables sterilization by radiating air coming from air ducts. Such sterilized air passes through filtration systems placed inside air ducts. In the said filtration systems there are compounds having antimicrobial effects. Such compounds provide sterilization for pathogen spores in air. Air passing through such filtration systems is supplied into refrigerator again via transmission ducts. Said application model is related to sterilization of the air inside refrigerator by a light source and filtration systems containing antimicrobial compounds.

Another patent application related to the issue is the application numbered WO2010/057969 (A1) and titled as "Coating Material with Antimicrobial Compounds and Use thereof" (sample number 8). In the summary of the said application model, it is mentioned of sterilizing with coating the insides of refrigerators with materials with antimicrobial properties. In the said application model, bearer part of the coating material is zeolite. Said zeolite is a material that has a high binding property. Onto such material it is possible to load any compound with antimicrobial impact. Such antimicrobial compounds may be Nickel (Ni), Palladium (Pd), Manganese oxide (MnO_2), and Silver (Ag). Such compounds may be used in combination by mixing the same with each other at different quantities. Said application method provides making use of antimicrobial impact of materials coated with said compounds. It is enabled sterilizing against microorganisms on inside surfaces of refrigerator coated with said coating material. Said application model is related to coating of refrigerator surfaces and sterilization against microorganisms.

Another patent application related to the issue is the application numbered WO0134686 (A2) and entitled as "Combining Inorganic Antibacterial Compounds with Flexible Cellular Material and Areas of Usage Thereof" (sample number 9). It is related to obtaining a coating material having an antibacterial effect by combining zeolite material and silver ions with antibacterial effect in the said application model. Said application model is related to releasing silver ions that are bound to zeolite element, by making use of humidity occurring in refrigerator. With the release of said silver ions, sterilization of bacteria colonized on inside surfaces of refrigerator. Said application model is related to coating of inside surfaces of refrigerator with antibacterial coating material and to elimination of microorganisms.

The common aspect of all these application models is related to elimination of pathogens in order for storing products in refrigerators for longer period of times, or elimination of odors, or recovering any water lost by products stored. Despite every one of existing techniques differentiates according to each other and the application manners thereof, in general in all of the application models, it is not possible to have elimination of pathogens truly obtained at desired extent.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 1, new formation by fogging of said ozone gas and humidity mixture will be as mist particles instead of gas phase. Consequently, it will not be possible to make use of sterilization effect of said fogging for those parts of products stored in vegetable compartment, such as lettuce, cabbage, Brussels sprouts, iceberg, head lettuce, etc. among the leaves thereof, having large and nested leaf structure, in comparison to making sterilization in gas phase. In the said application, converting those particles to be fogged into nano-scale is stated as an advantage of the system. In the said application model, even though those particles to be fogged are in nano-scale, it is not possible to have a large contact surface and a diffusion effect comparing to gas phase. The second disadvantage of the system in respect to the said application model is the chemical reaction taking place as result of combining ozone gas with humidity (Figure 1a). As result of said reaction, hydroxyl radicals (OH-) and hydrogen peroxide (H₂O₂) emerge. Said radicals and hydrogen peroxide have high oxidative and antimicrobial effects. Those radicals emerging as result of said reaction have a very short half-life. In the researchers conducted in scientific literature, it is stated that half-lives of hydroxyl radicals are to be 10⁻⁹ seconds (Sies, H. 1993). In the said application model, the interaction of ozone gas with humidity takes place inside the electrostatic atomizer. Consequently, said radicals form inside the atomizer. Such radicals formed inside said atomizer start undergoing to half-life as soon as they are formed and their efficiency decreases gradually. In the said model, fogging starts after formation of radicals. Consequently, it basically means that radicals having lost substantial part of their oxidative and antimicrobial impacts shall have been fogged. Likewise, until said radicals reach to surfaces of

products and refrigerator after being emitted from the atomizer and fogged, the process of said radicals' half-life continue. As result of this, where it should show basically an antimicrobial effect, it is not able to realize such efficacy to the extent as much as it is aimed. In the said patent (sample number 1), since inside surfaces of refrigerator are not coated with a coating material with antimicrobial impact, on those surfaces of products in contact with inside surfaces of refrigerator, there is no microbial sterilization. The most important disadvantage of the application model of the said patent is that no active microbial sterilization is taken place.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the application model of said patent with sample number 2, ozone gas is combined with water coming from water reservoir. In the said application model, larger amount of ozone gas concentration supplied will not realize diffusion into the water. In the said application model, ozone particles diffusing into water undergo to the half-life process very quickly. As result of said half-life process, it is not possible to make use of oxidative and antimicrobial effect of ozone molecules that are required to show efficacy. Likewise, after interaction of ozone gas with water in the same pipe line, when half-life process of said ozone gas continues until it comes to atomizer where fogging is to be done, concentration of the ozonized water arriving to the atomizer is at very low levels. Likewise, since those particles coming out of fogging have very little oxidative and antimicrobial properties at the moment they reach to those surfaces (inside surfaces of refrigerator, outer surfaces of vegetables and fruit) where they will have impact, it is not possible to have a sterilization as mentioned in the said patent.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 3, sterilization of products in the said patent is obtained by fogging by fogging unit after water passes thrice through the reservoir tank. In the said application model of the said patent, there is a disadvantage as recounted in other patent application models (sample number 1 and sample number 2). In the said application model, all during the time elapsing from that ozonized water passes through different tanks until it is in the system of fogging, the process of said half-life of ozone gas continues. Moreover, since the said patent applies ozonized water application, in the said application model, water increases the process of half-life of ozone gas. As a result, it is not possible to benefit from oxidative and antimicrobial impact of ozonized water.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 4, it is mentioned disintegration of undesired odors inside refrigerators. There is a device producing ozone gas enabling disintegration of such undesired odors. Such device is able to produce ozone gas at very low concentrations and facilitates disintegration of undesired odors in refrigerators only. The device mentioned in the said patent has no antimicrobial effect at all. Moreover, since there

is no system preventing reproduction and infestation of bacteria causing formation of undesired odors in refrigerators, no solution is brought forward for the cause of the problem, and formation of undesired odors continues by bacteria.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 5, no recovery of water lost by vegetables and fruit stored in refrigerators is realized. In the said application model, despite recovery of water lost by vegetables and fruit because of breathing and temperature differences is facilitated; having products constantly staying humid and that the water with which fogging is made does not contain any antimicrobial compounds promote development of bacteria existing on surfaces of products. The most important disadvantage of the said application model of the patent in concern is that it promotes development of pathogens existing on products while trying to protect physiological states thereof. In addition, having vegetable compartment continuously humid promotes development of microorganisms.

There are different disadvantages of existing application models and devices comparing to each other. For instance, the application model of the said patent with sample number 6 is very similar to the application model with sample number 1 of those patents. There is no difference between the said application model and the application model with sample number 1. The disadvantage of the said application model is exactly the same as of the patent with sample number 1. Microbial sterilization that the patent in question claims to realize is not able to realize it effectively due to that ozone gas and hydroxyl radicals have very short half-lives. In the said application model, ozone gas interacting with water circulates through air transmitting ducts inside refrigerator. The process of half-life continues all along such circulation time. Consequently, when said radicals reach to surfaces of refrigerator, vegetables and fruit, such microbial sterilization claimed cannot take place.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 7, it is claimed that air inside refrigerator is sterilized by a filtration system containing a light source (ultraviolet and blue light) and antimicrobial compounds. In the said application model of said patent, it is possible to sterilize air inside refrigerator with the said application model. On the other hand, the said application model has important disadvantages. Firstly, the elimination of microorganisms on inside surfaces of refrigerator or on those products stored in refrigerator is not possible by the said application model. Said application model only provides sterilization of the air in refrigerator. Consequently, those pathogens already on the products stored inside refrigerator continue to their growth and cause spoiling of products. Additionally, bacteria continuing their growth on inside surfaces of refrigerator cause undesired odors in refrigerator. There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 8, it is anticipated to have

elimination of microorganisms present on inside surfaces of refrigerator by coating refrigerator's inner surfaces with such elements with antimicrobial impact. The principal disadvantage of the said application model is to be able to sterilize only those microorganisms existing on inside surfaces of refrigerator. In the application model of the said patent, one of the most important disadvantages is not being able to do microbial sterilization of those surfaces of products stored in refrigerator that are not in contact with antimicrobial matter even though it does microbial sterilization on those parts that are in contact with such surfaces coated with antimicrobial matter. Besides, it is not able to sterilize particularly those fungi spores and allergens being suspended in the air inside refrigerator. Likewise, those microorganisms present in the outer environment will enter into refrigerator with each opening/closing of refrigerator's door. Additionally, it is possible that such microorganisms in the outer environment to enter into refrigerator and settle on products stored inside. That population increase of microorganism on all parts of said products in refrigerator that are not in contact with antimicrobial coating surfaces is one of the disadvantages of the said application model of this particular patent.

There are different disadvantages of existing application models and devices comparing to each other. For instance, in the said application model with sample number 9, it is aimed to sterilize by coating refrigerator's inner surfaces with silver ions with antimicrobial impact. The said application model of this particular patent works totally with the same principles of the application model of the patent with sample number 8. The disadvantages of the application model of the said patent with sample number 9 are identical with those of the patent with sample number 8 as previously mentioned. Basically, it is possible to sterilize those surfaces of products that are in contact with antimicrobial coating surfaces but nevertheless it is not possible to sterilize microorganisms on those parts of products stored in refrigerator that are not in contact with antimicrobial coating surfaces and the air in refrigerator.

In conclusion, the disadvantages of those aforementioned patents of which operating principles and application models are recounted in detail above are explained one by one for every one as to be specific for each system. In consideration of all those clarifications, aforementioned patents aim to provide sterilization of microorganism particularly present on products stored in refrigerator, on inside surfaces of refrigerators, and suspended in the air in refrigerator. All aforementioned patents have such disadvantages and defects in regards to sterilization in respect to both efficacy and having able to sterilize only certain parts. None of the existing system is able to provide an efficient sterilization of products and the air inside refrigerators or does facilitate simultaneous sterilization on all the parts. Therefore, it is needed to have new technologies and application models to provide additional advantages as well as to eliminate the disadvantages of the application models of the existing systems.

Technical problems that the invention intends to solve

The present invention meets those aforementioned needs through different methods and practices. Firstly, none the existing patents is able to simultaneous sterilization of products stored in and the air inside refrigerators as well as inner surfaces of refrigerators. By the virtue of the present invention, it is possible to sterilize all of the surfaces of products, the air in refrigerators, all the volume inside refrigerator and vegetables compartment.

In addition to the sterilization to be obtained on those surfaces of products stored in refrigerators that are in contact with antimicrobial coating material by coating inside surfaces of refrigerators with such materials of antimicrobial efficacy, since ozone gas will fill all volume spaces, it is possible to do much effective sterilization on inner surfaces of refrigerators, the air inside refrigerators and those products stored in refrigerators.

Since ozone gas (O_3), hydrogen peroxide (H_2O_2) and hydroxyl ($OH^\cdot$) radicals have very strong oxidative properties, it facilitates disintegration of any chemical and agricultural medicinal residues present on surfaces of products stored in refrigerators and making products much healthier.

It provides elimination of undesired and unpleasant odors originating due to bacterial colonies in refrigerators.

It provides disintegration and accumulation of ethylene gas that some products stored in refrigerators may produce, and that causes maturing and aging of vegetables and fruit and increasing the sensitivity against to pathogens thereof.

Aim of the Invention

The present invention is related to an application model that meeting aforementioned requirements, eliminating all the disadvantages and bringing forth additional advantages, and realizes efficient sterilization of products stored in refrigerators, inside surfaces of refrigerators and the air inside refrigerator completely, and enabling storage of products in much healthier way and for longer period of times.

One of the goals of the invention is to realize sterilization of microorganisms that may exist on all of the surfaces in refrigerators.

Another goal of the invention is the efficient sterilization and elimination of microorganisms on surfaces of products stored in such refrigerators.

Another aim of the invention is to realize sterilization of microorganisms and allergens present in the air in refrigerators.

Another aim of the invention is to facilitate sterilization and elimination of bacteria and microorganisms colonizing on the surfaces in such refrigerators and causing formation of undesired and unpleasant odors inside refrigerators.

Another aim of the invention is to realize sterilization and elimination of food borne pathogens present on products stored in such refrigerators and causing various diseases and immune system problems in human and animals.

Another aim of the invention is to realize sterilization and elimination of bacteria, mold, yeast and viruses that cause physiological and pathological problems in products stored inside such refrigerators.

Another goal of the invention is to facilitate the recovery of water lost by products stored in such refrigerators due to breathing and temperature differences.

Another goal of the invention is to slow down and to suppress aging and physiological functions of products stored in such refrigerators and to enable storage thereof for longer period of times.

Another aim of the invention is to provide disintegration and removal of ethylene gas from the environment, the gas that increases aging and sensitivity to pathogens of stored products released from vegetables and fruit stored in such refrigerators to the air in refrigerator or such spaces as vegetable compartment where they are stored.

Another goal of the invention is the disintegration of residues of chemicals, pesticides and agricultural medicinal compounds present on surfaces of products stored in such refrigerators.

Another aim of the invention is to facilitate sensitivity increases of microorganisms existing on the surfaces of or inside the products stored in such refrigerators and causing pathological decaying of products, by creating humidity inside refrigerators at high proportions.

Another aim of the invention is to make products much safe by disintegrating aflatoxin compounds which are produced by certain microorganisms and have carcinogenic effect on humans.

Another goal of the invention is to realize sterilization and elimination of viruses, causing various diseases in human beings, from surfaces of products, from inner surfaces of refrigerators and the air inside refrigerators.

The structural and characteristic properties and all of the advantages of the application model and devices of the invention providing foregoing technical advantages are to be understood in much clear way with the detailed written explanation by the figures given below and referencing thereto. Therefore, evaluation should be made by considering those figures and the detailed explanations.

Brief Description of Drawings

Figure 1: Refrigerator

Figure 2: Control panel

Figure 3: Vegetable compartment

Figure 4: Refrigerator body cross-section

Drawings do not need to be scaled. In order for understanding the present invention, unnecessary details may have been omitted. In addition, such elements at least substantially identical or at least having substantially identical functions are marked with the same number.

Reference Numbers

1. Refrigerator
2. Water reservoir
3. Additional water reservoir
4. Humidity source
5. Humidifying unit water transmitting line
6. Ozone gas connection unit
7. Ozone source
8. 8a, 8b Ozone sensor
9. 9a, 9b Humidity probe
10. 10a, 10b Fan
11. Control panel
12. 12a, 12b Ozone gas inlet
13. 13a, 13b Humidity inlet
14. Vegetable compartment
15. Ozone disintegration unit
16. Ozone disintegration unit connection line
17. Vacuum pump
18. Ozone disintegration unit outlet
19. External air inlet
20. Filtration system
21. Fresh air control valve
22. Fresh air transmitting line
23. Evaporator
24. Cold fresh air transmitting line
25. Cold fresh air inlet
26. Locking system
27. Internal air inlet
28. Drainage funnel
29. Additional water reservoir transmitting line
30. Additional water reservoir control valve
31. Cold air ducts
32. Cooler fan
33. Cold air inlet
34. Pre-sterilization control valve
35. Coating material that has antimicrobial efficacy

36. Switch for pre-sterilization mode
37. Refrigerator compressor
38. Freezer
39. Refrigerator outer surface
40. Refrigerator inner surface
41. Heat-insulated main body
42. Ozone disintegration inlet
43. 43a, 43b Ozone gas measuring inlet
44. 44a, 44b Ozone gas measuring transmitting line
45. 45a, 45b Humidifier unit water discharge line
46. Heat sensor
47. Vegetable compartment cover
48. Light source
49. Pre-sterilization control panel
50. Vacuum pump outlet transmitting line
51. Filtered air transmitting line
52. Water pump
53. Water pump water transmitting line
54. Multi-shelves
55. Refrigerator door
56. Water level sensor
57. LED
58. Reflector
59. 59a, 59b Ozone gas control valve
60. 60a, 60b Humidity control valve
61. Refrigerator compartment

Detailed Description of Invention

In this detailed explanation, structures preferred in refrigerators the subject matter of the invention is to be intended only for clarifying the subject better and to be explained as to not create any limiting effect.

Should the invention taken as regards to application elements thereof; firstly, there is a refrigerator (1) in a impermeable structure with heat insulated body into which all applications will be provided and where all necessary measurement will be made. Such refrigerator (1) of invention's subject matter may be manufactured in different volumetric sizes and of different materials. Such refrigerator (1) has three main compartments comprising of a main body with multi-shelves (54), a vegetable compartment (14) and freezer (38).

In the application of invention's subject matter, those equipments, lines and identical units in the same body originating from the identical source and going to different sections in refrigerator compartment (61) and vegetable compartment (14) are expressed with a and b next to the reference numbers thereof. Those of such mentioned equipments connected to refrigerator compartment (61) are indicated with a next to the reference number thereof, and those connected to vegetable compartment are with b next to the reference number thereof.

In the application of the invention's subject matter, water reservoir (2) is the water source from which water required for humidifying process. If required in the invention, there is an additional water reservoir (3) supplying water addition from outside refrigerator (1).

In the application of the invention's subject matter, facilitating humidity into refrigerator (1) at required levels is supplied by humidity source (4). In addition, water necessity required for humidification of refrigerator (1) is conducted through water transmitting line (5) of the humidification unit. Such water conduction line (5) of the humidification unit facilitates the connection between humidity source (4) and water reservoir (2).

In the application of the invention's subject matter, ozone gas is supplied into the refrigerator compartment (61) by ozone gas connection unit (6a and 6b). Ozone gas supplied by ozone gas connection unit (6a and 6b) is provided by ozone source (7). On such ozone gas connection unit (6a and 6b), there is an ozone gas control valve (59a and 59b). Such ozone gas control valve (59a and 59b) is controlled by control panel (11). Such ozone gas control valve (59a and 59b) consists of two lines going into vegetable compartment (14) and refrigerator compartment (61). Control panel (11) measures the ozone gas concentrations in refrigerator compartment (61) and vegetable compartment (14) separately via an ozone sensor (8a and 8b). Such ozone sensor (8a and 8b) is located in the control panel (11). In the application of the invention's subject matter, the ozone gas concentration range to be supplied into refrigerator compartment (61) and vegetable compartment (14) is 0.025-0.03 ppm. As result of this, where ozone concentrations of such compartments are different than each other, control panel (11) cuts ozone gas transmission, by ozone gas control valve (59a and 59b), to such compartment of which ozone concentration reaches to 0.03 ppm. Should ozone concentrations in said compartments be out of the dose range of 0.025-0.03 ppm; ozone gas control valve (59a and 59b) is brought to 'on' position and ozone gas transmission is continued by control panel (11). In the application process in question, when ozone gas concentration in any compartment goes below 0.025 ppm, control valve (59a and 59b) of that particular compartment opens up and ozone gas is supplied to relevant compartment. Likewise, in the application process in question, when ozone gas concentration in any compartment goes above 0.03 ppm, control valve (59a and 59b) of that particular compartment is closed and ozone gas transmission to relevant compartment is cut off. In the application of said invention, ozone gas produced by said ozone source (7) and humidity produced by humidifier (4) are provided to be distributed inside such

refrigerator (1) homogeneously by a fan (10a and 10b). Said ozone gas concentration is measured by control panel using ozone sensor (8a and 8b) and the humidity content is by using humidity probe (9a and 9b). Such data gathered by such humidity probe (9a and 9b) is transmitted to control panel (11) electronically. Such humidity data coming is evaluated by that control panel (11) and is ensured that humidity content is between 90-99.9%.

In the application of the invention in question, control panel (11) controls the ozone concentration produced by ozone source (7) and the humidity produced by humidifier (4). Said control panel (11) measures value of humidity content supplied into refrigerator (1) by the humidity probe (9a and 9b), and the ozone gas concentrations via ozone sensor (8a and 8b), and decides whether or not ozone source and humidifier will work.

In the application of the invention in question, ozone gas concentration inside said refrigerator (1) is measured by ozone sensor (8a and 8b). Measuring by said ozone sensor (8a and 8b) is carried out with transmitting such ozone gas absorbed by ozone gas measurement inlet in said refrigerator (1) to control panel (11) by ozone gas measurement transmission line (44a and 44b). Said control panel (11) has an ozone sensor (8a and 8b) in which ozone gas concentration transmitted by ozone gas measurement transmission line (44a and 44b) will be measured. Said ozone sensor (8a and 8b) is controlled by control panel (11) and data evaluation is carried out.

In the application of the invention in question, ozone gas is supplied into refrigerator (1) through ozone gas inlet point (12a and 12b) connected to ozone connection unit (6a and 6b), and humidity is through humidity inlet point (13a and 13b) connected to humidifier unit water outlet (45a and 45b).

In the application of the invention in question, there is a vegetables compartment (14) in refrigerator wherein vegetables and fruit will be placed. Such vegetable compartment (14) has a vegetable compartment lid (47) that is transparent and has opacity. Humidity into such vegetable compartment (14) is supplied through humidity inlet (13b). Likewise, ozone gas into such vegetable compartment is supplied through ozone gas inlet (12b). Ozone concentration inside such vegetable compartment (14) is disintegrated by ozone disintegration unit after pre-sterilization is completed. Transmission of ozone gas to be disintegrated by said ozone gas disintegration unit (15) to that ozone disintegration unit (15) is provided by ozone disintegration unit connection line (16). Ozone disintegration unit connection line (16) provides ozone gas absorption from vegetables compartment (14) through ozone disintegration inlet (42). Ozone disintegration inlet (42) provides ozone gas absorption from vegetables compartment (14) through vacuum pump (17). Such vacuum pump (17) is controlled by control panel (11). Connection between vacuum pump (17) and ozone disintegration unit (15) is provided by vacuum pump outlet transmission line (50). Vacuum pump outlet transmission line (50) provides transmission of ozone gas to ozone disintegration unit (15) for disintegration of ozone gas

absorbed by vacuum pump (17). Ozone gas disintegrated by ozone gas disintegration unit (15) converts to oxygen. Oxygen formed as result of disintegration of ozone gas is given off to out of refrigerator (1) by ozone disintegration unit outlet (18).

In the application of the invention in question, ozone gas concentration inside said refrigerator compartment (61) is measured by ozone sensor (8a) connected to control panel (11). Ozone gas is transmitted to ozone sensor (8a) by ozone gas measurement transmission line (44a). Connection of ozone gas measurement transmission line (44a) to refrigerator compartment (61) is provided by ozone gas measurement inlet (43a).

In the application of the invention in question, fresh air entry to vegetables compartment (14) is provided by external air inlet (19) upon disintegration of ozone gas in vegetable compartment (14) after pre-sterilization process. External air inlet enables accepting air into refrigerator (1) from outer environment. The air taken into through external air inlet (19) passes through the filtration system (20). Filtration system (20) facilitates catching bacteria, mold, yeast, virus, dust and allergens in the air taken into from outer environment. In the application model, facilitating the air, taken into from external air inlet (19) and passing through filtration system (20), to go to vegetable compartment (14) is provided by fresh air control valve (21) controlled by control panel (11). Transmitting the air passing through filtration system (20) to fresh air control valve (21) provides filtrated air transmission line (51). Fresh air control valve (21) is located on fresh air transmission line (22) facilitating transmission of the air taken into to vegetable compartment (14). Fresh air control valve (21) is opened by control panel (11) when air needed to be taken into vegetable compartment (14) and upon completion of air intake, it is turned off by control panel (11). The air transmitted by fresh air transmission line (22) is cooled down by passing through evaporator (23). Evaporator (23) is the chiller of refrigerator (1). In addition, it also facilitates cooling of fresh air taken into vegetable compartment (14). The air chilled in evaporator (23) is transmitted to vegetable compartment (14) through chilled fresh air transmission line (24). The air coming into vegetable compartment (14) through chilled fresh air transmission line (24) is supplied to vegetable compartment (14) through chilled fresh air inlet (25). Chilled fresh air inlet (25) is connected to internal air inlet (27). Internal air inlet (27) facilitates supplying chilled fresh air into vegetable compartment (14).

In the application of the invention, there is a lock system (26) preventing opening of vegetable compartment (14) while pre-sterilization takes place inside vegetable compartment (14). Lock system (26) is on (locked) position during pre-sterilization process and is controlled by control panel (11). Control panel (11) facilitates that lock system (26) is on/off position. Lock system (26) is brought to 'on' position by control panel (11) after fresh air intake through internal air inlet (27) upon the ozone concentration inside vegetable compartment (14) drops below 0.03 ppm.

In the application of the invention, there is a drainage funnel (28) under the evaporator (23). Drainage funnel (28) gathers the water formed as result of absorption of humidity around

evaporator (23) that is formed inside refrigerator (1). Drainage funnel (28) gathers the drained water in water reservoir (2). Amount of water accumulated in the water reservoir (2) is controlled by control panel (11) via water level sensor (56). Water level sensor (56) facilitates measuring of amount of water in the water reservoir (2). Control panel (11) ensures supplying of water needed, from additional water reservoir (3) in case amount of water inside water reservoir (2) is decreased. Transmitting water from additional water reservoir (3) to water reservoir (2) is facilitated through additional water reservoir transmission line (29). On the additional water reservoir transmission line (29) there is a control valve (30) for additional water reservoir. Said additional water reservoir control valve (30) is controlled by control panel (11). Control panel (11), if evaluates that amount of water in the water reservoir (2) is not sufficient, ensures getting water from the additional water reservoir (3) by facilitating the additional water reservoir valve (30) to be on/off positions.

In the application of the invention, the water necessary for humidity to be supplied into refrigerator (1) is provided by the water reservoir (2). Water from water reservoir (2) to humidifier (4) is provided by pumping it by water pump (52) to humidifier's water transmission line (5). Water taken from water reservoir (2) by water pump (52) is transmitted to humidifier (4) through water pump water transmission line (53). Water pump water transmission line (53) facilitates the connection between water pump (52) and humidifier (4). In case amount of water inside water reservoir (2) is not sufficient, water needed is supplied from additional water reservoir (3). Connection of humidifier (4) to refrigerator compartment (61) is facilitated by humidifier water outlet line (45a). On the water outlet line (45a) of humidifier there is a humidity control valve (60a). Humidifier control valve (60a) facilitates transmission of humidity from humidifier (4) to refrigerator compartment (61). Such humidity control valve (60a) is controlled by control panel (11). Connection of humidifier water transmission line (5) to refrigerator compartment (61) is enabled through humidity inlet (13a).

In the application of the invention, humidity to be supplied to vegetable compartment (14) is supplied through humidifier (4). Connection of humidifier (4) to vegetable compartment (14) is facilitated by humidifier water outlet line (45b). On the water outlet line (45b) of humidifier there is a humidity control valve (60b). Humidifier control valve (60b) facilitates transmission of humidity from humidifier (4) to vegetable compartment (14). Such humidity control valve (60b) is controlled by control panel (11). Connection of humidifier water transmission line (5) to vegetable compartment (14) is enabled through humidity inlet (13b).

In the application of the invention, in the refrigerator, there are chilled air channels (31) facilitating circulation of the air chilled in refrigerator (1) by evaporator (23). Chilled air channels (31) circulate the chilled air coming from evaporator via a chiller fan (32) in refrigerator (1). Chiller fan (32) distributes the chilled air in chiller air channels (31) inside refrigerator (1) homogeneously. On those chilled air channels (31), there are chilled air inlets (33), through

which chilled air reaches to every compartment of refrigerator. Chilled air inlets (33) facilitate the chilled air in chilled air channels (31) to be distributed inside refrigerator homogeneously. On the inlet coming from chilled air inlets (33) to vegetables compartment there is a pre-sterilization control valve (34). Such pre-sterilization control valve (34) is controlled by control panel (11). Pre-sterilization control valve is 'off' position in order to prevent the ozone gas in vegetable compartment (14) to mix into chilled air channels (31) during pre-sterilization process. After pre-sterilization is completed and when the ozone gas concentration in vegetable compartment (14) is down to 0,03 ppm and lower and upon supplying chilled fresh air through internal air inlet (27) and when temperature inside vegetable compartment (14) is fixed to 4-6°C, control panel (11) brings pre-sterilization control valve (34) to 'on' position and circulation of chilled air continues.

In the application of the invention, all surface areas inside refrigerator (1), multi-shelves (54), and vegetable compartment (14) are coated with a coating material (35) of antimicrobial effect. In the application of the invention, there is an optional pre-sterilization mode switch in vegetable compartment (14) facilitating pre-sterilization process to take place. Such pre-sterilization mode switch (36) is controlled by control panel (11). Control panel (11) deactivates the pre-sterilization mode switch (36) when it reaches to the maximum number of manual usage. Maximum number of manual usage means the number of pre-sterilization to be made by user in 24 hours. In the existing system, maximum number of manual usage is preferably defined as two. The reason behind limiting the number of manual usage to be made by user in pre-sterilization process is to prevent the risk of phytotoxicity (deformations and damages occurred as result of applications carried out) on products stored in vegetable compartment (14) in case the process is carried out at ozone concentrations higher than 0.03 ppm and for long period of times.

In the application of the invention, control panel (11) automatically carries out pre-sterilization once in every 24 hours in case pre-sterilization is not done by user manually. In the event pre-sterilization is carried out manually by user, control panel (11) carries out it automatically after 24 hours as of the completion of pre-sterilization that was manually carried out. Using pre-sterilization mode switch (36), pre-sterilization process being carried out automatically by control panel (11) may be stopped or this automatic operation program may be completely deactivated and used only manually.

In the application of the invention, operation of refrigerator (1) is driven by refrigerator's compressor (37).

In the application of the invention, there is a freezing compartment (38) in refrigerator (1). Freezing compartment (38) facilitates storage of products between 0°C and -24°C.

In the application of the invention, refrigerator (1) has a heat insulated main body (41) between the outer surface coating (39) and inner surface coating (40) of refrigerator.

In the application of the invention, there is a light source (48) on the lid of vegetable compartment (47) that helps sterilization of products and producing ultraviolet and blue light at

0-520 nm wavelengths. In the preferred application of the invention, UV treatment is performed at the vegetable compartment (47) by means of the light source (48) facilitating simulation with antimicrobial effect (253,7 nm), ozone generating and water (H_2O) decomposition (0-185 nm), ozone decomposition (185-300 nm), hydroxyl radicals production, pesticides decomposition and IR (Induced Resistance). Such light source (48) facilitates radiations of 520 nm and lower wavelengths. With the radiations of such wavelengths (185 nm and lower wavelengths) from light source (27), water (H_2O) breakdown into its (H^+ , OH^-) and yields to formation of such compounds with high oxidative potential. In addition, such light source (48) breaks down ozone gas (O_3) at such wavelengths (185-300 nm), and converts it to oxygen (O_2) and oxygen atom ($\text{O}^\cdot$). Oxygen atom emerging by breakdown of ozone gas reacts with water and provides formation of such compounds with high oxidative potentials (hydroxyl radicals, etc.). In addition, with the radiation from the light source (48) at such wavelengths, antimicrobial effect (253,7 nm) is facilitated and thus, facilitates resistance to produces against pathogens by providing IR (induced resistance) in produces. Another advantage of light source (48) is to maintain freshness of preserved produces by providing continuity of photosynthesis (400-520 nm). Light source (48) facilitates sterilization of products stored in vegetable compartment (14) by radiating at low wavelengths inside vegetable compartment (14). Supplying blue and ultraviolet lights produced by light source (48) is provided into the system by LED lamps (57). Prevention of radiation emitting from light source (48) from vegetable compartment (14) to other compartments and supplying the light wavelengths into vegetable compartment (14) is provided by a reflector (58). Likewise, light source (48) facilitates enlarging stomata on products stored in vegetable compartment (14). As a result, it enlarges diffusion and absorption surfaces of products and recovery of water lost by products are enabled much quickly. There is a transparent lid (47) with opacity for vegetable compartment between vegetable compartment (14) and light source (48).

In the application of the invention, there is a heat sensor (46) enabling measuring temperature of the air inside vegetable compartment (14). Such heat sensor (46) is controlled by control panel (11).

In the application of the invention, there is a pre-sterilization control panel (49) located on refrigerator's outer surface coating (39) that is able to program duration of pre-sterilization process and ozone gas concentration. Pre-sterilization control panel (49) is digital and any values keyed in for duration and ozone gas concentrations are programmed and applied by control panel (11). On pre-sterilization control panel (49), there are ready programs already installed with pre-recorded pre-sterilization doses and process durations.

In the application of the invention, there are multi-shelves (54) on which those products to be stored in refrigerator (1) are to be placed.

In the application of the invention, refrigerator (1) has a refrigerator door (55) that is hinged on an axis and has a main body (41) with heat insulation between refrigerator's outer surface (39) and inner surface (40).

Application Method of the Invention:

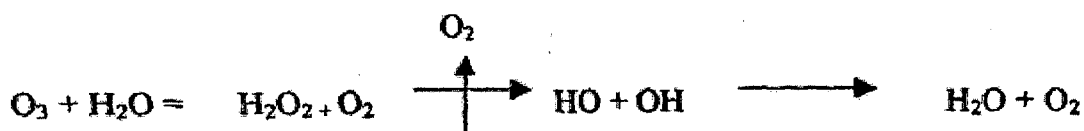
In the invention, refrigerator has a permeable main body (41) with heat insulation between refrigerator's outer surface (39) and inner surface (40). Refrigerator (1) has multi-shelves (54), vegetable compartment (14), freezing compartment (38) for storing products in, and refrigerator compressor (37) driving refrigerator (1). Refrigerator (1) has a refrigerator door (55) that is hinged on an axis and has a main body (41) with heat insulation between refrigerator's outer surface (39) and inner surface (40).

Those products to be stored and sterilized are placed in refrigerator (1). Afterward, the door of refrigerator (55) is closed. After closing the refrigerator door (55), control panel (11) measures humidity content in refrigerator (1) via humidity probe (9a and 9b). Upon measurement of humidity content by control panel (11), should humidity content in refrigerator (1) be less than 90% (<90%), control panel (11) operates humidifier (4) and fan (10a and 10b). Control panel (11) continuously measures humidity content during such application. When humidity content measured by humidity probe (9a and 9b) reaches to 99.9%, control panel (11) stops operation of humidifier (4) if humidity content in both compartments is in the target range. When humidity content drops again below 90% in both compartments, control panel (11) operates humidifier (4) again and enables the humidity in refrigerator (1) to go up to the desired range of value. In cases contrary to such application, control panel (11) closes the humidity control valve (60a and 60b) going to only relevant compartment but humidifier (4) continues to operate. In the application method in question, fan (10 a and 10b) provides that humidity supplied into refrigerator by humidity inlet (13a and 13b) and ozone gas supplied by ozone gas inlet (12a and 12b) are to be distributed homogeneously inside refrigerator (1). In the application method in question, first of all, as described in the goals of the invention, the purpose of increasing humidity content is to increase sensitivity of microorganisms on products' surfaces, refrigerator's surfaces or in the air inside refrigerator. In addition, by humidification made inside refrigerator (1), it is aimed to recover the water lost by products stored, due to breathing and temperature differences. In addition to all these, the most basic function of the application method in question is to facilitate increasing the efficacy of ozone gas prior to sterilization to be made by ozone gas. It is a scientific reality that the efficacy of ozone gas increases with humidity.

As shown in Figure 1a, after ozone gas (O_3) goes interaction with humidity, ozone gas forms hydrogen peroxide (H_2O_2) and hydroxyl radicals ($OH^\cdot$) that have strong oxidative and antimicrobial effect. This chemical conversion is repeatable and continuous conversion, and after interactions of ozone gas with humidity, both antimicrobial and oxidative properties of

ozone gas (O_3) and antimicrobial and oxidative properties of hydrogen peroxide (H_2O_2) and hydroxyl radicals ($OH^\cdot$) and ions are made use of in environment. In conclusion, efficacy is increased (J.Chen and P. Wang, 2005).

Diagram 1a - Reaction diagram showing the compounds originating as result of interaction of ozone gas with humidity.



Likewise, as shown in Figure 1b, after interaction of ozone gas with hydrocarbon compounds, hydroxyl compounds with high oxidative and antimicrobial effects occur in the environment as result of that reaction. As result of this, while ozone gas starts its oxidative effect, on the other hand hydroxyl radicals start to be active in oxidative manner. As result of such interaction both ozone gas and hydroxyl radicals are made use of their antimicrobial and oxidative effects.

Diagram 1b - Reaction diagram showing the compounds originating as result of interaction of ozone gas with hydrocarbon compounds.



Likewise, there is scientific literature indicating that fungi-toxic (having toxic effect against fungi) activity of ozone gas increases at relative humidity concentrations of 70% and over (Ozkan et al., 2011). It is known that bactericide and virucide activity of ozone gas is high. As result of scientific researches, it has been found that oxidative effect of ozone gas concentrations at increasing relative humidity levels during ozone gas and humidity interactions is more than the oxidative effect of the same ozone concentrations at lower relative humidity levels.

in the light of such information, supplying ozone gas and humidity simultaneously restricts efficacy of ozone gas. The first reason of this is that relative humidity will increase gradually in an environment to where mixture of ozone gas and humidity is supplied, and during such gradual increase, activity of ozone gas will also gradually increase. The second reason is the shortening of ozone gas' half-life when ozone gas supplied together with humidity, and consequently its efficacy diminishes. Where ozone gas and humidity are supplied together, when ozone gas meets humidity as soon as coming out of ozone source, ozone gas will react with humidity very quickly and the half-life will start in a very short time. During the time elapsed from the environment where ozone gas and humidity interact to where the application will take place, ozone gas and hydroxyl radicals will continuously half-live. In conclusion, where ozone

gas and humidity are supplied simultaneously, it is not possible to make full use of efficacy of ozone gas (H. Sies, 1993). Therefore, increasing the relative humidity of the environment prior to supplying ozone gas increases the efficacy of ozone gas. Besides, another reason for supplying ozone gas into refrigerator (1) only after humidity reaches to certain level is that particularly resistant pathogen spores will become much sensitive with the effect of increasing humidity (J. A. Gracia-Garza and D. R. Fravel, 1998; E. M. Johnson and T. B. Sutton, 2000; J. L. Smilanick and M. F. Mansour, 2007). Moreover, particularly for storage of fresh vegetables and fruit after harvest, having lost water physiologically increases both pathogen sensitivity of products and shortens the storage times of products. That the products interact firstly with humidity will lengthen the storage times thereof. Therefore, in the preferred application of the invention, supplying ozone gas into the system only after the environment is humidified sufficiently at approximately 90-99.9%. In the preferred application of the invention relative humidity is 90-99.9%.

When the invention is considered at operational principles, all the system to be described in operational principles and application methods recounted in refrigerator (1), refrigerator compartment (61) and vegetable compartment (14) will start only after humidification process. Humidification starts with supplying humidity from humidifier (4) into refrigerator (1), refrigerator compartment (61) and vegetable compartment (14), and with the supplying ozone gas provided that humidity inside aforementioned compartments is in the range of 90-99.9%. During the humidification process, fan (10a and 10b) runs continuously. Supplying ozone gas is provided by ozone source (7). Humidification and measuring thereof (11) is controlled by control panel (11). Control panel (11) starts sterilization process with ozone gas in the target humidity range after measuring humidity contents in all compartments via humidity probe (9a and 9b). Sterilization process is not carried out when humidity content in aforementioned compartments is less than 90%.

In the application method of the invention, the water necessary for humidifier (4) is provided by the water reservoir (2). Collection of water in water reservoir (2) is provided through drainage funnel (28). Draining water is carried out by absorbing humidity around evaporator (23) inside refrigerator (1) and draining the absorbed humidity transformed into liquid phase into drainage funnel (28) located under evaporator (23). Water drained from drainage funnel (28) accumulates in water reservoir (2). Amount of water in water reservoir (2) is measured by water level sensor (56). Such water level sensor (56) is controlled by control panel (11). Control panel (11) facilitates necessary water from additional water reservoir (3) in case it evaluates that amount of water inside water reservoir (2) is not sufficient. Additional water reservoir (3) is a container and enables to add necessary water from outside. Water from additional water reservoir (3) is supplied through additional water reservoir transmission line (29). On the additional water reservoir transmission line (29) there is a control valve (30) for additional water reservoir. Said

additional water reservoir control valve (30) is controlled by control panel (11). Additional water reservoir control valve (30) a valve system enabling to get water from additional water reservoir and controlled by control panel (11). Control panel (11) measures the amount of water in water reservoir (2) via water level sensor (56). Control panel (11) turns on the additional water reservoir control valve (30) located on additional water reservoir transmission line (29) if it evaluates that water in water reservoir is not sufficient upon that measurement. Upon opening of additional water reservoir control valve (30), water in the additional water reservoir is transmitted to water reservoir (2) through additional water reservoir transmission line (29). Transmitting water from water reservoir (2) to humidifier (4) is supplied through humidifier water transmission line (5). Transmission of humidifier water transmission line (5) into refrigerator (1) is through humidifier water outlet line (45a and 45b). Humidifier water outlet line (45a and 45b) facilitates transmission of water disintegrated by ultrasonic way by humidifier (4) into refrigerator (1).

In the application method of the invention, the water necessary for humidity to be supplied into refrigerator (1) is provided by the water reservoir (2). Water from water reservoir (2) to humidity source (4) is provided by pumping it by water pump (52) to humidifier's water transmission line (5). Water taken from water reservoir (2) by water pump (52) is transmitted to humidifier (4) through water pump water transmission line (53). Water pump water transmission line (53) facilitates the connection between water pump (52) and humidifier (4). In case amount of water inside water reservoir (2) is not sufficient, water needed is supplied from additional water reservoir (3). Humidity to be supplied to refrigerator (1) is supplied through humidifier (4). Transmitting water to humidifier (4) is supplied through humidifier water transmission line (5). Connection of humidifier water transmission line (5) to inside of refrigerator (1) is enabled through humidity inlet (13a and 13b).

In the application method, on the water outlet line (45a and 45b) of humidifier there is a humidity control valve (60a and 60b). Such humidity control valve (60a and 60b) is controlled by control panel (11). Such humidity control valve (60a and 60b) consists of two lines going into vegetable compartment (14) and refrigerator compartment (61). Control panel (11) measures the humidity in refrigerator (61) and vegetable (14) compartments separately via a humidity probe (9a and 8b). As a result, where humidity contents of compartments are different from each other, control panel (11) cuts off the humidity transmission to the compartment with a relative humidity of 90-99.9% via humidity control valve (60a and 60b). For any of compartments with a relative humidity less than 90%, humidity control valve (60a and 60b) remains 'on', and humidification is continued by control panel (11). Humidifier water outlet line (45a and 45b) facilitates transmission of water molecules disintegrated into gas state via ultrasonic way by humidifier to the refrigerator compartment (61) through humidity inlet (13a). Humidity inlet (13a) is located

over the fan (10a) facilitating ozone gas and humidity to be distributed inside refrigerator compartment (61) homogeneously.

In the application method of the invention, there is a fan (10a and 10b) facilitating ozone gas and humidity to be distributed inside refrigerator compartment (61) and vegetable compartment (14) homogeneously. Fan (10b and 10b) is controlled by control panel (11). Fan (10a and 10b) is run continuously by control panel (11) during humidification and supplying ozone gas.

In the application method, ozone gas is provided into refrigerator (1) by ozone source (7). Ozone source (7) obtains ozone gas production using corona discharge or ultraviolet methods and others similar. In the application of the invention in question, ozone gas concentration inside said refrigerator (1) is measured by ozone sensor (8a and 8b) in the control panel (11). Ozone gas is transmitted to ozone sensor (8a and 8b) by ozone gas measurement transmission line (44a and 44b). Connection of ozone gas measurement transmission line (44a and 44b) to refrigerator compartment (61) and vegetable compartment (14) is provided by ozone gas measurement inlet (43a and 43b). Ozone gas obtained from ozone source (7) is transmitted into refrigerator (1) through ozone gas control valve (59a and 59b) that is located on ozone gas connection unit (6a and 6b) and controlled by control panel (11). Ozone gas control valve (59a and 59b) facilitates cutting off transmission of ozone gas by control panel (11) and supplying necessary ozone gas concentration. Entry of ozone gas connection unit (6b and 6b) into refrigerator (1) is facilitated by ozone gas inlet (12a and 12b). Ozone gas inlet (12a and 12b) is located over the fan (10a and 10b). Ozone gas inlet (12a and 12b) facilitates supplying of ozone gas produced by ozone source (7) into refrigerator (1). In the application of the invention in question, ozone gas concentration provided into refrigerator (1) is measured by ozone sensor (8a and 8b). Ozone gas sensor (8a and 8b) is controlled by control panel (11). Control panel (11) determines for how long and at which concentrations ozone gas will be supplied into refrigerator (1). Control panel (11) fixes ozone gas concentration inside refrigerator (1) at the range of 0.025-0.03 ppm. Likewise, control panel (11) fixes ozone gas concentration in vegetable compartment (14) at the range of 0.025-0.03 ppm unless a different dose is determined for pre-sterilization process. Control panel (11) continuously measures ozone concentration inside refrigerator (1) via ozone sensor (8b and 8b). As result of measurements taken by ozone sensor (8a and 8b), if ozone concentration inside refrigerator (1) is below 0.025 ppm for both compartments, control panel (11) opens ozone gas control valve (59a and 59b) and operates ozone source (7) again. Ozone source (7) is controlled by control panel (11). When ozone concentration inside refrigerator (1) is over 0.03 ppm in each compartment, control panel (11) turns off ozone gas control valve (59a and 59b) and stops running of ozone source (7), and enables ozone concentration to go down to the target levels of 0.025-0.03 ppm. Likewise, if control panel (11) determines after ozone gas concentration inside refrigerator (1) is measured by ozone sensor (8a and 8b) that ozone concentration values in both compartment

are below 0.025 ppm, turns on the ozone gas control valve (59a and 59b) again and activates ozone source (7). Control panel (11) fixes ozone gas concentration inside refrigerator (1) at the levels of 0.025-0.03 ppm.

In the application method of the invention, control panel (11) facilitates activation of ozone source (7) and humidifier (4) continuously or discontinuously. Control panel (11) controls the operation of the system according to the upper and lower limits of ozone gas and humidity concentrations in refrigerator (1). Control panel (11) controls targeted ozone gas concentration (0.025-0.03 ppm) and humidity concentration (90-99.9%) as result of measurements made by ozone sensor (8a and 8b) and humidity probe (9a and 9b). Control panel (11) facilitates running of the system steadily and in the range desired by bringing humidifier (4), ozone source (7), ozone gas control valve (59a and 59b) and humidity control valve (60a and 60b) to 'on/off' positions basing on the values obtained from ozone sensor and humidity probe. In addition, where ozone gas concentrations and humidity contents in refrigerator compartment (61) and vegetable compartment (14) are different, control panel (11) turns on and off ozone control valve (59a and 59b) and humidity control valve (60a and 60b) in order to obtain targeted values (ozone gas concentration at 0.025-0.03 ppm and relative humidity at 90-99.9%). On the other hand, where relative humidity and ozone gas concentrations in both compartments are 90-99.9% and 0.025-0.03 ppm respectively, it turns off both the control valves and ozone source (7) and humidifier (4). In the application process, the fan (10a and 10b) runs continuously, and facilitates homogeneous distribution of ozone gas and humidity inside refrigerator (1).

In the application method of the invention, in cases where the pre-sterilization process is not carried out in the vegetable compartment (14) if a difference between the ozone gas concentrations between the refrigerator compartment (61) and the vegetable compartment (14) occurs, the control panel (11) eliminates the ozone gas concentration difference between the compartments by turning on or off ozone gas control valve (59a, 59b), which provides ozone gas transmission to the compartment that is below or above the aimed value (0.025-0.03 ppm ozone gas concentration). While it turns on the ozone gas control valve for the compartment with lower ozone gas concentration it turns off the control valve for the compartment with the high ozone gas concentration. As soon as the ozone gas concentration in both compartments reaches aimed ozone gas concentration it turns off the ozone control valves (59a, 59b) that provide ozone gas transmission to the said compartments and the ozone resource (7) as well. Whenever the ozone gas concentration values between the said compartments are outside the aimed ozone gas concentration range (0,025-0,03 ppm), the control panel ensures that there is ozone gas concentration in the compartments at the aimed values by turning the related ozone gas concentration valve on/off likewise. The said operating principle also applies in case of differences in humidity levels between the compartments. The aimed humidity level in the said compartments is 90-99.9%.

The refrigerator (1) mentioned in the application method of the invention has a vegetable compartment (14) that permits saving vegetables, fruits and various food products. Entire interior surface of the said vegetable compartment (14) is covered with a covering material with antimicrobial effect (35). Above the said vegetable compartment (14) is placed a transparent vegetable cover (47), which is also light permeable. Behind the said vegetable compartment, there is a fan (10b) for realizing the pre-sterilization process and an opening for ozone gas input point (12b) and humidity input point (13b). Similarly, around the said opening there are humidity probe (9b) for measuring the humidity, ozone gas measurement entry (43b) for measuring the ozone gas concentration, ozone breaking entry point (42) and internal air entry point (27) on the fan (10b). the air temperature inside the said vegetable compartment is measured by a temperature sensor (46). The said temperature sensor (46) is controlled by the control panel (11). Whenever the temperature inside the said vegetable compartment (14) goes above the values between 4-6°C, based on the data from the temperature sensor (46) to the control panel (11), the control panel (11) turns on the clean air valve (21) and ensures that the temperature is dropped to the desired level between 4-6°C by providing cool air entry into the vegetable compartment (14). Within the vegetable compartment (14) mentioned in the application method of the invention, it is possible to carry out pre-sterilization process. The said pre-sterilization process is the process that ensures raising the humidity of the microorganisms on the products up to 90-99.9% levels and then realization of the sterilization manually or automatically within the vegetable compartment (14), which is covered with coating material with antimicrobial effect (35) at ozone gas concentration level above 0.03 ppm. In the application method of the invention, there is a pre-sterilization mode button (36) in the vegetable compartment (14) that ensures the performance of pre-sterilization based on the desire of the user. The said pre-sterilization mode button (36) is controlled by the control panel (11). The control panel (11) deactivates the said pre-sterilization mode button (36) when the daily maximum manual usage number is achieved. The said maximum manual usage number means the number of pre-sterilization processes that can be carried out by the user within 24 hours. In the existing system, the maximum manual usage number has been decided as 2. The reason for deciding on the number of manual usages to be realized by the user within 24 hours as 2 is to prevent the risk of formation of phytotoxicity on the products kept in the vegetable compartment (14) in case of carrying process at ozone gas concentrations over 0.03 ppm and within the specified periods.

In the application method of the invention, in case the ozone gas concentration that is requested to be used in the pre-sterilization process intended in the vegetable compartment (14) is between concentrations of 0.025 and 0.03, the operating principle of the system is the same as the sterilization process in the refrigerator compartment (61) and it runs completely the same at concentrations between 0.025 and 0.03 by using the same steps and equipment. If the pre-

sterilization process intended in the said vegetable compartment (14) is at a ozone gas concentration higher than 0.03 ppm, the application system is controlled in a different way by the control panel (11). Firstly, for the pre-sterilization process in the said vegetable compartment (14), the humidity level in the said vegetable compartment (14) is measured by the humidity probe (9b). If the humidity source (4) and humidity control valve (60b), the said humidity source (4) provides the humidity to the said vegetable compartment (14) from the humidity entry point (13b) via the humidity unit water output line (45b). the said control panel (11) continuously measures the humidity concentration in the vegetable compartment (14) via the humidity probe (9b). Whenever the said humidity probe (9b) measures that the humidity concentration in the vegetable compartment (14) reaches 99.9%, the control panel (11) closes the humidity source (4) and the humidity control valve (60b). Similarly, in cases where the humidity concentration inside the vegetable compartment (14) falls below 90%, the control panel (11) ensures that the humidity concentration inside the said vegetable compartment (14) remains between 90% and 99.9% by opening the humidity source (4) and humidity control valve (60b). the said control panel (11) keeps the fan (10b) running throughout the entire process and ensures that both the humidity and ozone gas concentration is distributed homogenously inside the vegetable compartment (14). In the said application method, if both the humidity and ozone gas concentrations inside the vegetable compartment (14) and refrigerator compartment (61) are within the aimed ozone gas concentration range 0.01-0.03 and the humidity range (90-99.9%), both the humidity source (4) and the ozone source (7) are closed. Otherwise, if the ozone gas concentration and the humidity level inside the said compartments are not within the aimed values, only the control valves providing ozone gas and humidity transmission to the related compartment is closed while the ozone source (7) and humidity source (4) continues ozone gas and humidity transmission to the compartment, which is not in the aimed range.

In the application method of the invention, the ozone gas coming from the ozone gas connection unit (6b) to the vegetable compartment (14) via the ozone gas control valve (59b) is provided through the ozone gas entry point (12b). The ozone gas concentration provided into the said vegetable compartment (14) is measured by the ozone sensor (8b). The said ozone sensor (8b) is controlled by the control panel (11). The said control panel (11) provides that the ozone concentration arranged for pre-sterilization is controlled. If the ozone gas concentrations to be used throughout the said pre-sterilization process are above 0.03 ppm, the pre-sterilization control valve (34), which is located behind the vegetable compartment (14) and provides connection between the said vegetable compartment (14) and the cool air channels, (31) is kept at closed position. When doses above 0.03 ppm are used during pre-sterilization process, the said pre-sterilization control valve (34) is turned off by the control panel (11). The said pre-sterilization control valve (34) prevents high ozone gas concentrations from entering the cool air channels (31) during the pre-sterilization process. The basic reason for this is that

the high ozone gas concentrations have a disturbing smell and irritating structure for humans. The closed pre-sterilization control valve (34) prevents high ozone gas concentrations preferably used in pre-sterilization process from entering the cool air channels (31) and reaching inside the refrigerator (1). Throughout the said pre-sterilization process, the fan (10b) that ensures homogenous distribution of the ozone gas and humidity provided inside the vegetable compartment (14) operates continuously. The said fan (10b) is controlled by the control panel (11). The ozone concentration inside the vegetable compartment (14) is measured by the ozone sensor (8b) during the pre-sterilization process. The values measured by the said ozone sensor (8b) are assessed by the control panel (11). The doses and the periods to be used in the pre-sterilization process can also be set by entering digitally from the pre-sterilization control panel (49) located on the refrigerator (1). The said pre-sterilization control panel (49) is also controlled by the control panel (11).

The ozone gas inside the vegetable compartment (14) mentioned in the application method of the invention is broken down by the ozone gas breaking unit (15). The absorption of the ozone gas inside the vegetable compartment (14) is carried out by the vacuum pump (17). The said vacuum pump (17) absorbs the ozone gas inside the vegetable compartment (14) via the ozone break-up entry point (42). The ozone gas, which is absorbed via the ozone break-up entry point (42), is transferred to the vacuum pump (17) through the ozone break-up unit connection line (16). The ozone gas, which is absorbed by the said vacuum pump (17) is transferred to the ozone break-up unit (15) through the vacuum pump output transfer line (50). The ozone gas, which is broken-up by the said ozone break-up unit (15), is discharged to outer environment by the ozone break-up unit output point (18) after being broken up. The said ozone break-up unit output point (18) realizes the discharge of the ozone broken up by the ozone break-up unit (15) by converting it into oxygen.

With the start of the break-up of the ozone gas inside vegetable compartment (14) mentioned in the application method of the invention, the clean air control valve (21) is turned on and clean air entry into the vegetable compartment (14) is ensured by the external air input (19). The external air input (19) provides air input to the vegetable compartment (14). The air taken from external air input (19) to the vegetable compartment (14) passes through the filtration system (20).

In the application method of the invention, the air, which is taken from the external air input (19) and passes through the filtration system (20), is transferred to the clean air control valve (21) by the filtered air transmission line (51). The said filtration system (20) ensures that the bacteria, mold, ferment, virus, dust and allergens are kept. The said filtered air transmission line (51) provides the connection between the filtration system (20) and the clean air control valve (21). The transmission of the air, which passes through the filtration system (20), to the vegetable compartment (14) is provided by the clean air control valve (21), which is controlled by the

control panel (11). The said clean air control valve (21) is opened by the control panel (11) simultaneously with the ozone break-up unit (15) and vacuum pump (17), and thus the air passage is provided. The said clean air control valve (21) is located on the clean air transmission line (22) that provides the air taken for vegetable compartment (14) is transmitted to the vegetable compartment (14). The said clean air control valve (21) is brought to open position by the control panel (11) when it is required to intake clean air inside the refrigerator, and brought to closed position by the control panel (11) when the air intake process is completed. The clean air transmission line (22) is connected to the evaporator (23). Evaporator (23) is the cooler of the said refrigerator (1) and ensures that the incoming clean air is cooled. The clean air cooled at the evaporator (23) is transmitted to the vegetable compartment (14) by the cool clean air transmission line (24). The air transmission to the vegetable compartment (14) from the said cool clean air transmission line (24) is provided by the internal air input point (14) connected at the cool clean air entry point (25). The said vacuuming process and air provision into the vegetable compartment (14) is carried out at the same time. The concurrent vacuuming of ozonic air inside the said vegetable compartment (14) with the provision of cool clean air by the internal air entry point (27) ensures that the temperature inside the vegetable compartment (14) remains within the aimed range of 4-6°C. Additionally, it prevents the negative pressure that might occur inside the vegetable compartment (14) during the vacuuming process. Moreover, high ozone gas concentration is diluted by providing cool clean air into the said vegetable compartment (14) from the internal air entry point (27). As a result of this, ozone gas concentration drops down quickly. The reason for providing the air after cooling at the evaporator (23) is to ensure that the products, which are kept inside the vegetable compartment (14) and subjected to pre-sterilization process, are kept in a cold manner. The temperature value (4-6°C) of the products prior to the pre-sterilization process is maintained the same way inside the said vegetable compartment (14). It is probable that the new products to be placed inside the vegetable compartment (14) might be subjected to a higher temperature in the outside environment, thus, the new products are cooled down quickly and the temperature is decreased to 4-6°C range very rapidly. Provision of air into the said vegetable compartment (14) without cooling causes the products kept inside the vegetable compartment (14) to warm and their physiologies to expedite, and accordingly the products to age fast. In the said application method, the reason for providing cool clean air to the vegetable compartment (14) by the internal air entry point (27) following the pre-sterilization process and during vacuuming the air inside is to prevent products to warm and at the same time to prevent products to age fast by suppressing their development physiologies. Following the completion of the said ozone gas break-up process, when the ozone gas concentration inside the vegetable compartment (14) decreases down to the level of 0.03 ppm and the temperature inside the vegetable compartment (14) is between 4-6°C, pre-sterilization control valve (34), which is controlled by

the control panel (11), and locking system (26), which prevents the vegetable compartment (14) from opening during the pre-sterilization process, are brought to open position and the pre-sterilization process is finalized.

Cooling of the refrigerator (1) mentioned in the application method of the invention is provided by the evaporator (23). The said evaporator (23) ensures that the air inside the refrigerator (1) is cooled and the interior of the refrigerator (1) maintained cold. The cool air coming from the said evaporator (23) is distributed homogenously inside the refrigerator by the cooling fan (32). The said cooling fan (32) provides the cool air circulation inside the refrigerator (1). The said cooling fan (32) ensures that the air cooled by the evaporator is circulated inside the cool air channels (31). The said cool air channels (31) provides the transmission of the cool air coming from the evaporator (23) into the refrigerator (1). Along the said cool air channels are located refrigerator compartment (61), vegetable compartment (14) and cool air entries (33) that provide cool air access to every corner of the refrigerator (1). The said cool air entries (33) are small air channels that are located on the cool air channels (31) and that ensure the access of cool air to every corner inside the refrigerator (1).

In the application method of the invention, there is a locking system (26) in the vegetable compartment (14). The said locking system (26) locks and prevents the opening of the vegetable compartment (14) in case ozone gas is provided in concentrations above 0.03 ppm during the pre-sterilization process. The said locking system (26) is controlled by the control panel (11). The locking system (26) is kept in locked position by the control panel (11) during pre-sterilization processes with ozone gas concentrations above 0.03 ppm until the pre-sterilization process is completed. If pre-sterilization process is ongoing inside the vegetable compartment (14), the said locking system is locked by the control panel (11). The said locking system is kept at locked position until the high ozone gas concentrations inside the vegetable compartment (14) are absorbed by the vacuum pump (17), transferred to ozone break-up unit by the ozone break-up unit connection line (16), discharged from the ozone gas break-up unit output point (18) following the break-up of high ozone gas concentrations. During the said ozone gas break-up process, the control panel (11) measures the ozone gas concentration inside the vegetable compartment (14) via the ozone sensor (8b). In order to drop the ozone gas concentration to 0.03 ppm level, the said control panel (11) ensures that the ozone gas concentration is absorbed by the vacuum pump (17), transferred to the ozone break-up unit (15) by the ozone break-up unit connection line (16) and discharge of the ozone gas concentration, which is broken up here, through the ozone gas break-up unit output point (18). The said control panel (11) at the same time ensures that cool clean air is provided into the vegetable compartment (14) from the internal air entry point (27). As a result of this, the ozone gas concentration is lowered down to the desired level of 0.03 ppm and the products are cooled. When the ozone gas concentration inside the vegetable compartment (14) is lowered inside the

range of 0.025-0.03 ppm and when the temperature inside the vegetable compartment (14) is fixed between 4-6°C, the locking system (26), which prevents vegetable compartment (14) from opening during the pre-sterilization process, is opened. Following the said process, the control panel (11) unlocks the locking system (26) and the vegetable compartment (14) brought to open position. Similarly, when the ozone gas concentration inside the vegetable compartment (14) drops down to 0.025-0.03 pp range, the pre-sterilization control valve (34), which is controlled by the control panel (11) and which prevents high ozone gas concentrations from entering the cool air channels (31) and inside the refrigerator (1) throughout the pre-sterilization process, is opened too. Within the said process, with the opening of the pre-sterilization control valve (34) and the locking system (26), the pre-sterilization process is completed.

In the application method of the invention, the entire interior surface of the said refrigerator (1) and the interior surface of the vegetable compartment (14) are covered with coating material with antimicrobial affect (35). Thanks to the coating material with antimicrobial effect (35), the sterilization of the products to be kept inside the refrigerator (1) is not limited only to the oxidative and antimicrobial effects of the ozone gas, hydrogen peroxide (H_2O_2) and hydroxyl radicals ($OH^\cdot$). Additionally, sterilization will be carried out on product surfaces that come into contact with the coating material with antimicrobial affect (35).

In the said application method both the efficiency of ozone gas (O_3), hydrogen peroxide (H_2O_2) and hydroxyl radicals ($OH^\cdot$), which have oxidative and antimicrobial effect, and the efficiency of covering materials with antimicrobial effect (35) are benefited from. As a result of this, the products, kept in the refrigerator compartment (61) and vegetable compartment (14), are protected by dual-sided sterilization process and microbial sterilization is provided more efficiently. The part within the said covering material with antimicrobial effect (35) that will connect to the compounds and elements with antimicrobial effect can be compounds such as zeolite, silica gel, calcium phosphate, silicate, titanium oxide, titanium dioxide etc.

In the application method of the invention, the part of the covering material with antimicrobial affect (35), which is comprised of different compounds based on the choice, that carries the antimicrobial compounds might react with the radiation from the light source (48) inside the refrigerator (1) that might be used optionally. As a result of the probable interaction, due to the chemical interaction with the radiation, in cases where titanium oxide carrier is used, hydroxyl radicals ($OH^\cdot$) are formed inside the refrigerator with the effect of radiation combined with the humidity inside the refrigerator. Thus, in the said application method, the antimicrobial, oxidative and sterilization effects of the covering material with antimicrobial effect (35), the light source (48) and the hydroxyl radicals ($OH^\cdot$) that are formed as a result of radiation and humidity are benefited. As a result, the products that are desired to be kept benefit from the sterilization effect of the covering material with antimicrobial effect and the hydroxyl radicals that are formed

from the reaction with the radiation and sections carrying the antimicrobial compounds following radiation, and thus a triple protection is established.

In the application method of the invention, a light source (48) that generates an ultraviolet and blue light at 400 nm and 520 nm wavelengths assisting in the sterilization of the products is placed on the vegetable compartment cover (47). The said light source (48) has LED lamps (57) that provide illumination of the different light lengths generated to the vegetable compartment (14). The said light source (48) has a reflector (58) that ensures the beams with different wavelength coming off the LED lamps (57) go only to the vegetable compartment (14) and prevents them from scattering around. The said light source (48) radiates at lower wavelengths and provides the sterilization of the products kept inside the vegetable compartment (14). There is a transparent vegetable compartment cover (47) that is light permeable between the vegetable compartment (14) and the light source (48). The said light source (48) radiates at lower wavelengths inside the vegetable compartment (14) and provides the sterilization of the products kept inside the vegetable compartment (14). The said light source (48) similarly causes the stomas of the products that are kept inside the vegetable compartment (14) to expand and ensures that the products regain in a short period of time the amount water they lose by expanding the diffusion and absorption surfaces.

In the application method of the invention, when the refrigerator door (55) is opened while pre-sterilization process is not running manually or automatically, the fans (10a, 10b), humidity source (4), ozone source (7) and light source (48) are turned off by the control panel (11). Similarly, when the refrigerator door (55) is opened while the pre-sterilization process is ongoing, the fan (10a) inside the refrigerator (1), humidity unit control valve (60a) and ozone gas control valve (59a) are turned off by the control panel (11). Additionally, the light source (48) inside the vegetable compartment (14) is also turned off by the control panel (11) if the refrigerator door (55) is opened while the pre-sterilization process is ongoing. On the other hand, if the refrigerator door (55) is opened while the pre-sterilization process is ongoing inside the said vegetable compartment (14) the fan (10b) inside the vegetable compartment (14) continues with the humidifying process and ozone gas provision. Additionally, the said vegetable compartment (14) is kept locked and prevented from opening by the locking system (26). When the pre-sterilization mode button (36) is brought to off position manually by the user while the said pre-sterilization process is ongoing, the control panel terminates the pre-sterilization process and ensures that the ozone gas inside the vegetable compartment (14) is absorbed from the vegetable compartment (14) and ensures provision of clean air into the vegetable compartment (14) section at the same time with the vacuuming process. Whenever the ozone gas concentration inside the vegetable compartment (14) falls down to 0.03 ppm and below, and the temperature inside the vegetable compartment (14) as measured by the

temperature sensor (46) falls down to 4-6°C range, the said control panel (11) ensures that the locking system (26) that prevents the vegetable compartment (14) from opening is opened. Similarly, the said control panel (11) operates and checks the operation of all systems when the refrigerator door (55) is closed.

In the application method of the invention, the pre-sterilization process is stopped either manually by pre-sterilization mode button (36) or by the control panel (11) at the end of the period entered into the pre-sterilization control panel (49). In order to stop the pre-sterilization process inside the vegetable compartment (14) the said control panel (11) first turns off the ozone gas control valve (59b) and prevents ozone gas provision into the said vegetable compartment (14). Following this process, the control panel (11) continuously measures the ozone gas concentration by means of the ozone gas measurement entry (43b). Likewise, the control panel (11) measures the temperature inside the vegetable compartment (14) by means of the temperature sensor (46). When the pre-sterilization process is terminated as explained, the control panel turns on the vacuum pump (17) and initiates the ozone gas absorption from the vegetable compartment by means of ozone break-up entry point (42b). Concurrently with the start of the said absorption process, the control panel (11) turns the clean air control valve (21) and ensures that cool clean air is provided into the vegetable compartment (14) through the internal air input (27). Throughout the entire process, the fan (10b) inside the vegetable compartment (14) runs and humidity provision from the humidity entry point (13b) inside the vegetable compartment (14) continues. Whenever the ozone gas concentration inside the vegetable compartment (14) falls down to 0.03 ppm and below, and the temperature inside the vegetable compartment (14) is within the range of 4-6°C, the said control panel (11) opens the locking system (26) that prevents the vegetable compartment (14) from opening. As a result of this, the vegetable compartment (14) is made ready for use by the user.

In the application, which is the subject of the invention, after the refrigerator door (55) is closed, the entire system is restarted by the control panel (11). In the said restart process, the control panel (11) brings and fixes the humidity inside the refrigerator to 90-99.9%, the temperature inside the refrigerator to the range of 4-6°C and the ozone gas concentration inside the refrigerator to 0.03 ppm.

In the application, which is the subject of the invention, when the pre-sterilization process is terminated manually by the user with the pre-sterilization mode button (36) without opening the refrigerator door (55) or by the pre-sterilization control panel (49) at the end of the period and dose used in the pre-sterilization process, the system will be restarted in two minutes automatically by the control panel (11). The said control panel (11) brings and tries to fix the humidity inside the refrigerator to 90-99.9%, the temperature inside the refrigerator to the range of 4-6°C and the ozone gas concentration inside the refrigerator to 0.025-0.03 ppm range.

In the application, which is the subject of the invention, whenever the refrigerator door (55) is opened, the light source (48) is always turned off by the control panel (11).

Method for applying the invention in the industry

The application method, which is the subject of the invention, is an application method, which is easy to transfer into the industry. The said application method can be used for household and industry type refrigerators while it is also possible to use at product processing facilities, packaging facilities, fresh vegetable and fruit depots, readymade product facilities, meat, milk and dairy product and animal product production facilities, warehouses, houses, in environments with bad odors and cars. The said invention can also be designed in a compact form, and it is possible to expand the usage fields by making it portable.

References

1. Chen, J., Wang, P. 2005. Effect of relative humidity on electron distribution and ozone production by DC coronas in air. IEEE Transactions On Plasma Science, Vol. 33, No. 2.
2. Ozkan, R., Smilanick, J.L., Karabulut, O.A. 2011. Toxicity of ozone gas to conidia of *Penicillium digitatum*, *Penicillium italicum*, and *Botrytis cinerea* and control of gray mold on table grapes. Postharvest Biology and Technology 60, 47–51.
3. Sies, H. 1993. Strategies of antioxidant defense. European Journal of Biochemistry 215, 213-219.
4. Gracia-Garza, J. A., Fravel, D. R., 1998. Effect of relative humidity on sporulation of *Fusarium oxysporum* in various formulations and effect of water on spore movement through soil. Phytopathology 88, 544-549.
5. Johnson, E. M., Sutton, T. B. 2000. Response of two fungi in the apple sooty blotch complex to temperature and relative humidity. Phytopathology 90, 362-367.
6. Smilanick, J. L., Mansour, M. F. 2007. Influence of temperature and humidity on survival of *Penicillium digitatum* and *Geotrichum citri-aurantii*. PlantDisease. 91, 990-996.

CLAIMS

1. The invention is related to an application system with an ozone source (7) that generates ozone gas providing the sterilization and elimination of the bacteria, mould, yeast, virus and allergens present on the products kept inside the refrigerator, internal surfaces of the refrigerator, in the air inside the refrigerator and inside the refrigerator, which has a body (41) and/or compartments (61, 14, 38) and/or shelves (54) and/or refrigerator door (55) covered with antimicrobial coating material (35) or made up from compounds with antimicrobial effect, and it is ***characterized in that it***;
 - it comprises a humidity source (4) that ensures the realization of humidifying process, maintains the freshness of the products to be kept and increases the efficiency of the ozone gas.
2. It is an application system according to Claim 1; and it is ***characterized in that it***; an ozone source (7) that generates the ozone gas concentrations required for performing the said sterilization process.
3. It is an application system according to Claim 1; and it is ***characterized in that it***; a humidity source (4) that can create high relative humidity (90-99.9%) inside the said refrigerator (1).
4. It is an application system according to Claim 1 ;, and it ***is characterized in that it***; that the refrigerator (1) inner surfaces and the inner surfaces of multiple shelves (54) and vegetable compartment (14), where the products can be placed inside the refrigerator (1), are covered with coating material with antimicrobial effect (35).
5. It is an application system according to Claim 1; and it is ***characterized in that it***; inside the said refrigerator (1) a vegetable compartment (14) where the products can be kept and the said pre-sterilization process can be carried out.
6. It is an application system according to Claim 5; and it is ***characterized in that it***; a light source (48) above the said vegetable compartment (14) that can radiate blue light and ultraviolet wavelengths.
7. It is an application system according to Claim 1 and 5; and it is ***characterized in that it***; a pre-sterilization valve (34) in the said vegetable compartment (14) that prevents high ozone

gas concentrations penetrate to the refrigerator (1) and the cool air channels (31) during the pre-sterilization process.

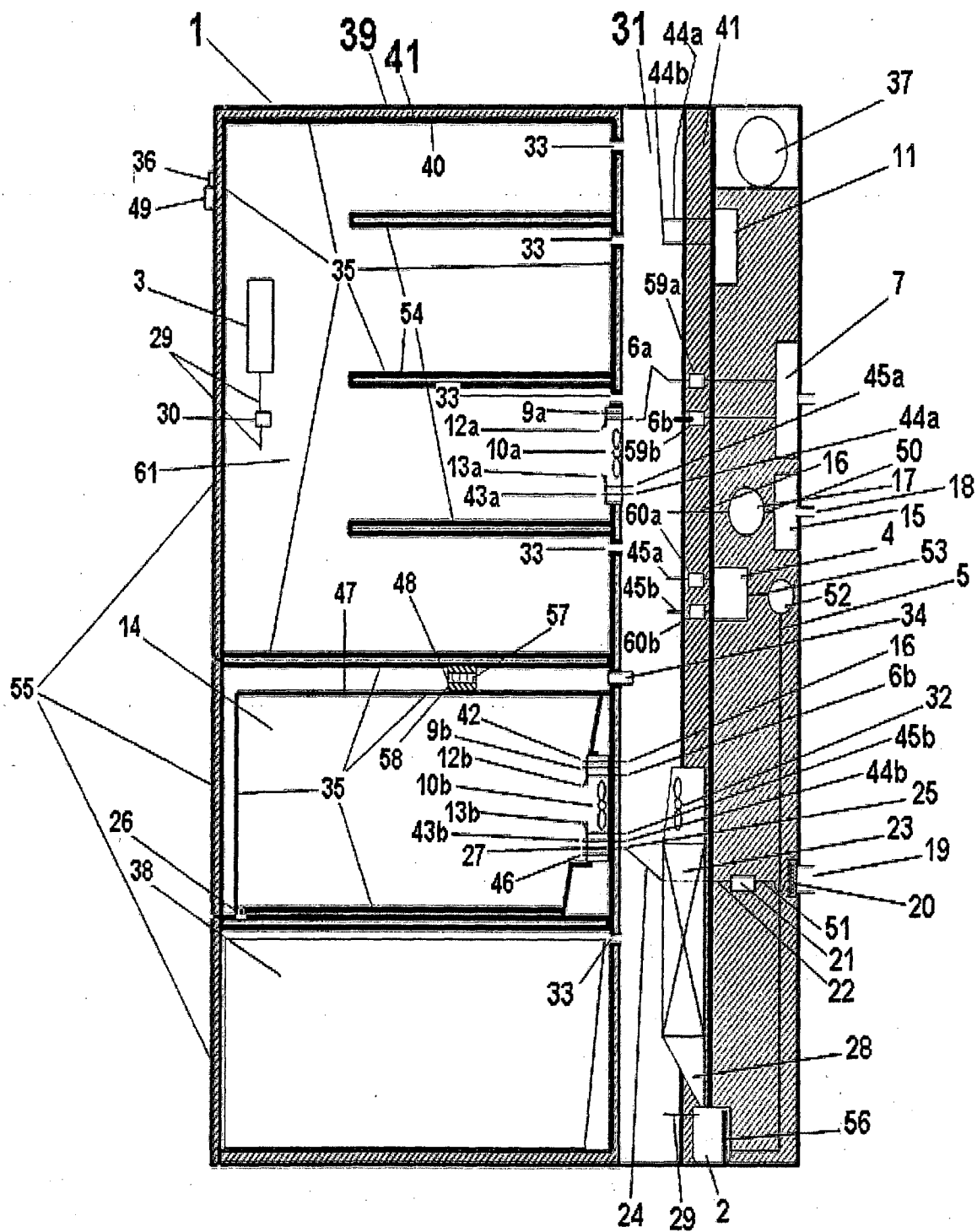
8. It is an application according to Claim 5; and it is **characterized in that it**; a locking system (26) inside the said vegetable compartment (14) that prevents the vegetable compartment (14) from opening during the pre-sterilization process.
9. It is an application system according to Claim 1 and 5; it is **characterized in that it**; a pre-sterilization mode button (36), with which the user can initiate the pre-sterilization process.
10. It is an application system according to Claim 1 and 5; it is **characterized in that it**; a pre-sterilization control panel (49), from where the ozone gas concentrations and application periods to be used during the sterilization process can be determined.
11. It is an application system according to Claim 1 and 5; it is **characterized in that it**; a fan (10a, 10b) that provides the homogenous distribution of ozone gas, humidity and cool air within the said refrigerator compartment (61) and the vegetable compartment (14).
12. It is an application system according to Claim 1 and it is **characterized in that it**; an evaporator (23) that cools inside the said refrigerator (1).
13. It is an application system according to Claim 1 and 12; it is **characterized in that**; a drainage funnel (28) that enables obtaining water by absorption of high humidity air, which is cooled by the evaporator (23).
14. It is an application system according to Claim 12 and 13; it is **characterized in that** a water reservoir (2) that collects water, which is drained by the drainage funnel (28).
15. It is an application system according to Claim 1 and it is **characterized in that**; cool air channels (31) that enable the transmission of cool air inside the refrigerator (1).
16. It is an application system according to Claim 1 and 15; it is **characterized in that** cool air entries (33) that enable cool air transmission to all compartments inside the said refrigerator (1).

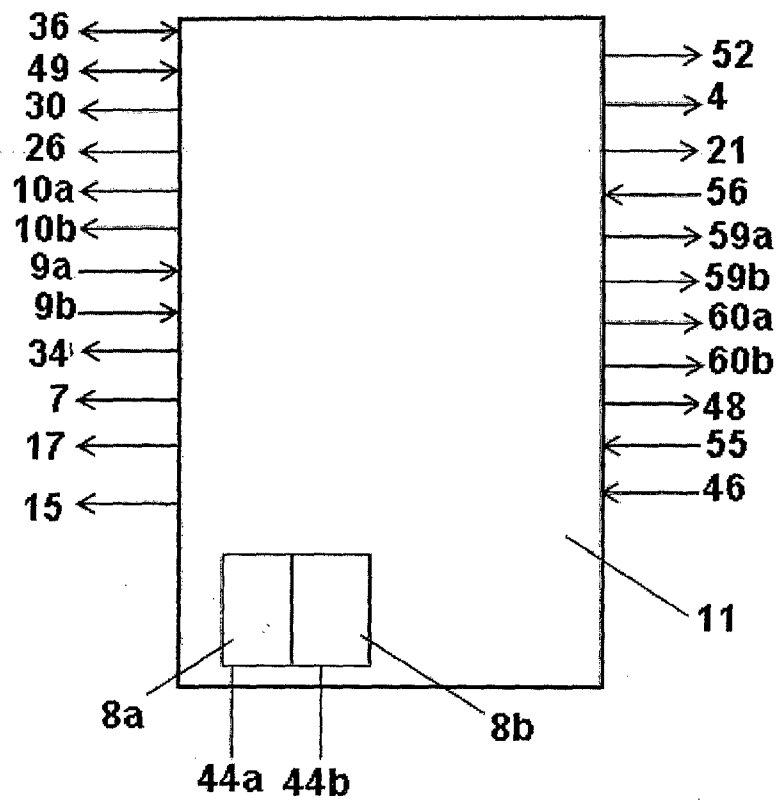
17. It is an application system according to Claim 1 and 15; it is **characterized in that**; a cooler fan (32) that transmission and circulation of cool air inside the said refrigerator (1) that is cooled by the evaporator (23) to cool air channels (31) and cool air entries (33).
18. It is an application system according to Claim 1 and 5; it **is characterized in that**; a temperature sensor (46) that enables the measurement of temperature inside the said vegetable compartment (14).
19. It is an application system according to Claim 1 and 5; it is **characterized in that**; an ozone break-up entry point (42) that enables the absorption of ozone gas following the completion of pre-sterilization process within the said vegetable compartment (14).
20. It is an application system according to Claim 1 and 5, it is **characterized in that**; internal air entry point (27) that enables cool clean air entry into the said vegetable compartment with the start of ozone gas absorption following the completion of pre-sterilization process within the vegetable compartment (14).
21. It is an application system according to Claim 1; it is **characterized in that**; ozone gas entry point (12a, 12b) that enables ozone gas entry into the said refrigerator compartment (61) and the vegetable compartment (14).
22. It is an application system according to Claim 1; it is **characterized in that**; humidity entry point (13a, 13b) that enables entry of humidity into the said refrigerator compartment (61) and the vegetable compartment (14).
23. It is an application system according to Claim 1; it is **characterized in that**; a control panel (11) that enables all the said measurements, assessments and mechanical controls inside the said refrigerator (1), and that controls and maintains the continuity of the operation of all mechanical and digital components.
24. The invention is the application method of the system that includes the steps of ozonizing process by means of an ozone source, which enables the sterilization of the microorganisms on all the surfaces inside the refrigerator (1), in the air inside the refrigerator (1) and on the surfaces of the products to be kept inside the refrigerator (1) by benefiting from the antimicrobial effect of the body (41) and/or compartments (61, 14, 38) and/or shelves (54) that are covered with antimicrobial coating material (35) or comprised of compounds with antimicrobial effect, and it is characterized in that;

- That includes process steps such as the entry of humidity, which increases the efficiency of the ozone gas inside the refrigerator (1) and maintains the freshness of products, by the humidity source (4) with specific amounts into the refrigerator (1) and following the achievement of the aimed humidity range (90-99.9%), performance of the sterilization process through ozonizing process.
25. It is an application method according to Claim 24 and it is **characterized in that**; that it includes the steps of distributing the humidity and ozone gas concentration, which are provided into the refrigerator (1) at specific amounts), homogenously by the fan (10a, 10b) into the refrigerator compartment (61) and vegetable compartment (14).
26. It is an application method according to Claim 24 and it is **characterized in that**; that it includes the process step of placing products to be kept into the vegetable compartment (14), where the pre-sterilization process takes place and which allows the keeping of products within the refrigerator (1).
27. It is an application method according to Claim 24 and it is **characterized in that**; that it includes the process step of absorbing and condensing the humidity, which is formed inside the refrigerator (1), and cooling the said refrigerator by the said evaporator (23).
28. It is an application method according to Claim 24 and 26, it is **characterized in that**; that it includes the process step of operating the locking system (26) that keeps the said vegetable compartment (14) locked during the entire pre-sterilization process.
29. It is an application method according to Claim 24 and 26, it is **characterized in that**; that it comprises the process step of preventing the high ozone gas concentrations from entering the cool air channels (31) by closing the pre-sterilization valve, which prevents the passage of high ozone gas concentrations (>0.03 ppm) inside the said vegetable compartment (14) during the pre-sterilization process to the said refrigerator (1) and cool air channels (31).
30. It is an application method according to Claim 24 and 26, it is **characterized in that**; that it comprises the process step of sterilization by benefiting from the antimicrobial effect on the surfaces of the said refrigerator (1) and the vegetable compartment (14), which are covered with coating material with antimicrobial effect (35).
31. It is an application method according to Claim 24 and 26, it is **characterized in that**; that it comprises the process step of turning on or off the pre-sterilization mode button (36), which

is located on the said refrigerator (1), which can be used manually by the user, and which enables the initiation or termination of the pre-sterilization process that takes place inside the vegetable compartment (14).

32. It is an application method according to Claim 24 and it is **characterized in that**; that it comprises the process step of sterilizing products that are kept inside the vegetable compartment (14) by benefiting from the radiation effect of the light source (48), which is located above the said vegetable compartment cover (47) and which enables radiation at blue light and ultraviolet wavelengths, and causing the stomas of the products that are kept inside the vegetable compartment (14) to expand and ensuring that the products regain in a short period of time the amount water they lose by expanding the diffusion and absorption surfaces.
33. It is an application method according to Claim 24 and it is **characterized in that that** it comprises the process step of realizing the pre-sterilization process by entering the ozone gas concentrations and periods to be used in the pre-sterilization into the pre-sterilization control panel (49) and by determining the desired ozone gas concentration and application period.
34. It is an application method according to Claim 24 and it is **characterized in that**; that it comprises the process step of placing the products, which are desired to be kept inside the refrigerator (1), on the multiple shelves (54).
35. It is an application method according to Claim 24 and it is **characterized in that**; that it comprises the process step of providing ozone gas concentration into the refrigerator compartment (61) and vegetable compartment (14) by the ozone gas entry point (12a, 12b), which enables ozone gas provision into the said refrigerator compartment (61) and the vegetable compartment (14).
36. It is an application method according to Claim 24; it is characterized in that; that it comprises the process step of providing humidity into the refrigerator compartment (61) and vegetable compartment (14) by the humidity entry point (13a, 13b), which enables humidity provision into the said refrigerator compartment (61) and the vegetable compartment (14).

**Figure 1**

**Figure 2**

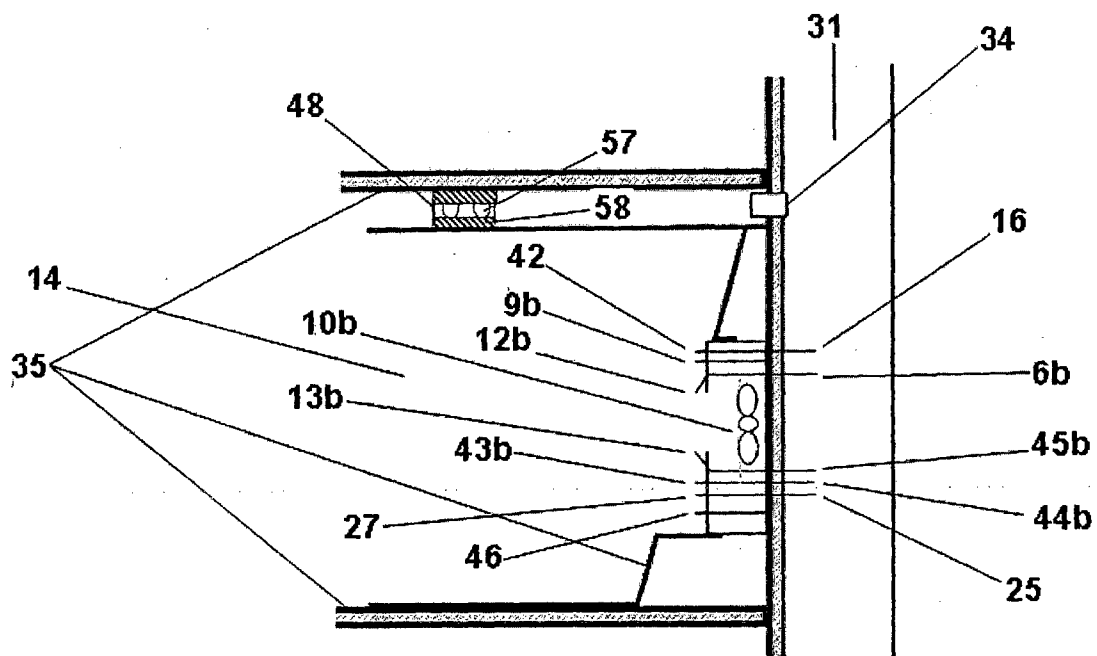


Figure 3

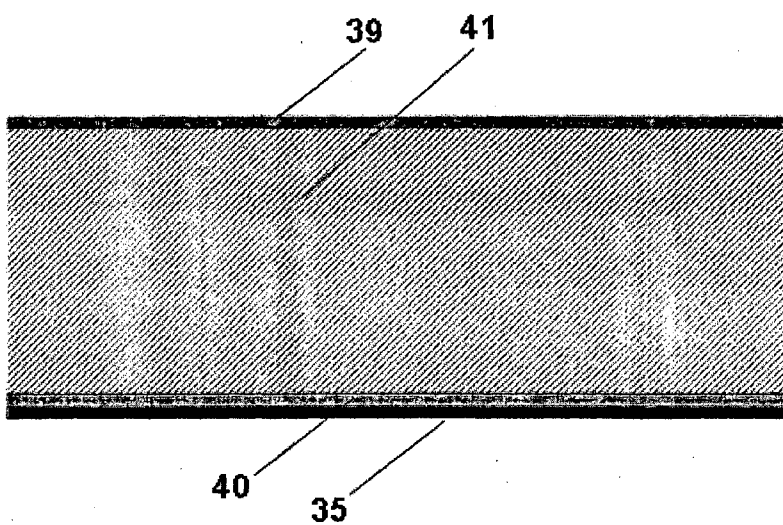


Figure 4