Title: METHOD FOR TREATING FOOD AND DEVICE FOR MAKING SUCH METHOD

Abstract: The invention relates to a method for treating food, comprising the following operating steps: - a step a) of preparing a closed chamber destined to receive the food to be treated inside it, cold generating means comprising a refrigerator circuit provided with at least one evaporator, heat generating means and ventilation means able to generate a circulation of air affecting the chamber, the evaporator and the heat generating means, being associated with the chamber; - at least one step b) of thermically treating the food inside the chamber supplying heat in a controlled manner so as to keep the air temperature of the chamber within a predefined value range \( \Delta T_1 \), alternating, with or without intermediate interruptions, sub-steps b1) of supplying heat, in which the heat generating means and ventilation means are simultaneously operative, with sub-steps b2) of removing heat in which the cold generating means and ventilation means are simultaneously operative, depending on the course of the real temperature in the chamber in relation to said predefined value range \( \Delta T_1 \). The invention also relates to a device for making such treatment.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
DESCRIPTION

"Method for treating food and device for making such method"

Field of application

[0001] The present invention relates to a method for treating food and a device for making such method.

[0002] The method and the device according to the invention are of particularly advantageous application in the domestic field in the thermic treatment of food requiring accurate temperature control.

[0003] Even more in particular, the method and the device according to the invention make it possible to implement thermic treatments requiring control of the humidity.

[0004] The method and the device in particular make it possible to treat and to preserve food in ideal conditions from a hygienic-health point of view, avoiding the permanence of such foods in environmental conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of their nutritional and organoleptic characteristics.

State of the art

[0005] Electric devices for the thermic treatment of food are known, in which the temperature inside the treatment chamber is controlled by regulating the activity of electric resistors depending on the values detected in
the chamber by a thermic probe.

[0006] Generally temperature control envisages the on-off adjustment of the resistors. This type of adjustment does not however ensure always accurate temperature control on account of the thermic inertia of the system.

[0007] Another limit of the aforesaid traditional devices lies in the difficulty of controlling the humidity inside the chamber. This problem is especially felt for foods which must not be dried out or dehydrated during cooking. For this type of application, traditional systems may be provided with systems able to reintegrate the humidity removed in the chamber by spraying nebulised water or steam inside it.

[0008] These reintegration systems do not however permit accurate adjustment of the humidity, unless sophisticated humidity detection and control systems are implemented. In any case the risk of introducing too much humidity into the chamber and thereby altering the cooking exists.

[0009] In general, the thermic treatment devices of food described above present in any case the problem (not yet resolved) of not permitting— at the end of cooking and in the case in which the cooked food is not immediately eaten— a preservation of the same for an indefinite time in ideal conditions from a hygienic-health point of view, avoiding the permanence of the same in environmental
conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of its nutritional and organoleptic characteristics.

[0010] As is known, bacterial proliferation in food and the consequent loss of its nutritional and organoleptic characteristics are favoured when the food is maintained in environments with an air temperature of 25°C to 45°C. In this temperature range bacterial proliferation is extremely rapid.

[0011] Above 45°C proliferation begins to be hindered with a substantial inhibition above 60°C. An analogous phenomenon occurs below 25°C, below which bacterial proliferation begins to be hindered, increasingly so as the temperature approaches 10°C. Below +3°C bacterial proliferation is substantially inhibited.

[0012] The aforementioned problem is particularly felt in the domestic field, given that the cooked food not destined to be eaten immediately is left to cool at room temperature before being placed in the refrigerator or freezer.

[0013] As it slowly cools the food inevitably picks up bacteria. Despite being subsequently preserved in the refrigerator or freezer, when it is eaten the food will be in a seriously jeopardised hygienic condition and will have poor or at least altered organoleptic and
nutritional characteristics.

[0014] These issues can be resolved using devices able to perform rapid cooling and/or freezing of food products destined to be preserved at low temperatures, known as temperature chillers. Such devices traditionally use a powerful refrigerator system able to produce rapid cooling or freezing as far as the core of the food products, inside an insulated cell.

[0015] The refrigerator system and the cell are generally scaled to ensure the so-called "core" cooling of a food product roughly from a starting temperature of about 70°C to a temperature of about +3°C in a time of not more than 90 minutes. Similarly the refrigerator system and the cell are generally scaled to also ensure the core freezing of the same product at a temperature of about -18°C in a time of not more than 4 hours. The installed power is therefore significantly higher than that provided in the traditional refrigerator systems destined for the preservation of chilled or frozen products.

[0016] Normally, temperature chillers are destined for use in collective catering services such as restaurants, canteens and delicatessen or patisserie facilities.

[0017] However, over the last few years the use of temperature chillers has become increasingly widespread in the domestic field too as a result of increasing
awareness of the importance of preserving food correctly.

[0018] The correct use of chillers however requires the presence of an operator who, on completion of cooking, subjects the food to the effect of the chiller and then when chilling is completed places the food in a refrigerator or freezer for long term preservation.

[0019] In the field of collective catering this method of operating does not create any difficulties since it falls within routine procedures.

[0020] Diversely, in the domestic field this operating mode may frequently prove inapplicable. In fact it is increasingly common to have a lifestyle which already prevents dedicating the necessary time to the preparation of food as a result of the little time available and which would therefore be irreconcilable with the need to not only supervise the cooking of food but also its correct treatment for preservation of the same.

[0021] Refrigerators exist provided with an inner chamber also utilisable to keep cooked foods hot, in particular at temperatures of over 50°C to prevent bacterial proliferation, as described for example in the patent applications EP 1806553A1 and EP1826515A1. The heat is supplied to the chamber by electric resistors positioned inside the chamber itself. The temperature inside the chamber during thermic treatment is regulated solely by
managing the resistors in on-off mode or by varying the load factor. Temperature control is not efficient however on account of the thermic inertia of the system. In addition, no control of the air humidity is envisaged.

Presentation of the invention

[0022] Consequently, the purpose of the present invention is to eliminate the drawbacks of the prior art mentioned above, by making available a method for treating food and a device for making such method which permit accurate control of the temperature of thermic treatment.

[0023] A further purpose of the present invention is to make available a method for treating food and a device for making such method which permits accurate control of the humidity during the thermic treatment.

[0024] A further purpose of the present invention is to make available a method for treating food and a device for making such method which makes it possible to treat and to preserve food in ideal conditions from a hygienic-health point of view, avoiding the permanence of such foods in environmental conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of the nutritional and organoleptic characteristics, without requiring the presence of an operator so as to adapt to the requirements for use in the domestic field.
[0025] A further purpose of the present invention is to make available a method for treating food which be implemented in a simple and immediate manner.

[0026] A further purpose of the present invention is to make available a device for implementing the method for treating food according to the invention which is simple and economical to make.

**Brief description of the drawings**

[0027] The technical characteristics of the invention, according to the aforesaid purposes, can be seen clearly from the contents of the following claims and the advantages of the same will be more clearly comprehensible from the detailed description which follows, made with reference to the appended drawings, showing one or more embodiments by way of non-limiting examples, wherein:

[0028] Figure 1 shows a perspective view of a device for treating food according to a preferred embodiment of the present invention with some parts not illustrated for a clearer view;

[0029] Figure 2 shows a front view of the device in Figure 1 with a forced air flow affecting a treatment chamber of the food and a first technical compartment shown schematically.

[0030] Figure 3a shows a rear perspective view of the
device illustrated in Figure 1 with some parts of the support structure not shown so as to better view a second technical compartment;

[0031] - Figure 3b shows a rear perspective view of the device illustrated in Figure 1 deprived of its rear closure panel;

[0032] - Figure 4 shows a front view of the device in Figure 1 illustrated with the access door to the chamber closed;

[0033] - Figure 5 shows a cross-section view of the device illustrated in Figure 4 according to the line V-V therein indicated;

[0034] - figure 6 shows an enlargement of the detail relative to the magnetic closure means of the door, highlighted in the circle VI shown in Figure 5;

[0035] - figures 7 to 10 show the course of the air temperature over time inside the food treatment chamber during different steps of thermic treatment according to a preferred form of implementation of the method according to the invention, the figures being relative respectively to a step of cooking at low temperature, to a step of regeneration, to a raising step and to a defrosting step;

[0036] - figures 11 and 12 show the course of the air temperature over time inside the food treatment chamber
during two different steps of cooling according to a preferred form of implementation of the method according to the invention, the figures being relative respectively to a rapid chilling step and a freezing step.

Detailed description

[0037] For simplicity's sake the method of treatment will be described subsequently to the device for treating food destined in particular to perform such method.

[0038] Here and henceforth in the description and the claims "thermic treatment" will be understood as a treatment in which the food is brought to a temperature of over +10°C, preferably not less than +15°C, even more preferably not less than +55°C.

[0039] With reference to the appended drawings reference numeral 1 globally denotes a device for treating food according to the present invention.

[0040] Here and henceforth in the description and the claims, reference will be made to the device 1 in conditions of use. Any references to a lower or upper, vertical or horizontal position should therefore be understood in this sense.

[0041] According to a general embodiment of the invention, the device 1 for treating food comprises:

[0042] a chamber 3 destined to receive the foods to be treated inside it;
[0043] - cold generating means 10 comprising a refrigerating circuit provided with at least one evaporator 11, a compressor 12 and a condenser 13;

[0044] - heat generating means 20; and

[0045] - ventilation means 30 generating a circulation of air A which affects the chamber 3, the evaporator 11 and the heat generating means 20.

[0046] The device 1 comprises a first technical compartment 4, fluidically communicating with the chamber 3, in which the heat generating means 20, the evaporator 11 and the ventilation means 30 are housed, and a second technical compartment 5 thermically insulated from the first compartment 4 and from said chamber 3, in which the compressor 12 and condenser 13 are housed. Preferably, inside the second technical compartment 5 one or more fans 14 are provided able to generate a forced circulation of external air on the condenser 13.

[0047] As will be clarified below when describing the method for treating food according to the present invention, the presence of the cold generating means 10 and of the heat generating means 20 permits accurate regulation of the temperature inside the chamber 3.

[0048] Preferably, the chamber 3 and the first technical compartment 4 form a volume hermetically closable from the outside, affected by the aforesaid air circulation A.
As will be clarified below describing the method according to the present invention, this makes it possible to keep the humidity which may be released by the food during the thermic treatment inside the chamber and the first technical compartment, thereby making its redistribution on the food possible.

[0049] In particular, the device 1 comprises a support structure 2 partially visible in Figures 3a and 3b. In particular, the support structure comprises a support base 200 able to support a box-like containment structure 201 open on one side and formed of a plurality of insulated panels 202 connected to each other by four angular supports 203. Such box-like structure 201 defines within it the volume corresponding to the chamber 3 and to the first technical compartment 4.

[0050] As may be observed in particular in Figures 1 and 2, the inner volume of the box-like structure 201 is divided into two parts by a dividing wall 204: a first part defines the chamber 3 and the second part defines the first technical compartment 4. At least two apertures 205 and 206 are made on such dividing wall 204 to permit the entrance of air from the chamber 3 into the first technical compartment 4 and the return of the air from the latter to the chamber 3.

[0051] As illustrated clearly in Figure 5, the two
apertures 205 and 206 are made in positions distanced from each other in such a way that the ventilation means 30 and the evaporator 11 may be placed between them and the air may traverse these two components before leaving the first technical compartment.

[0052] In particular, the ventilation means 30 comprise at least one centrifugal fan positioned at the aperture 205.

[0053] Advantageously, the device 1 comprises an access door 7 to the chamber 3 able to close the open side of the box-like structure 201 and a hermetic sealing gasket 9 positioned in the abutment zone of the door 7 on the support structure 201 of the device 1.

[0054] Preferably, the device 1 is provided with magnetic means 8 positioned opposite the hinging area of the door 7 to hold it closed and compress the gasket 9.

[0055] More in detail, as illustrated in Figures 5 and 6, the magnetic means 8 comprise at least two elements 8a and 8b, susceptible to reciprocal magnetic attraction, of which one 8a joined to the door 7 and one 8b joined to the support structure 2.

[0056] Advantageously, as illustrated in particular in Figures 1 and 2, the evaporator 11 is a finned tube heat exchanger and the heat generating means 20 comprise at least one resistor thermically connected to the finned tube heat exchanger. This increases the thermic exchange
surface available during the heating step too, permitting a more uniform distribution of the thermic power applied and therefore a more uniform heating of the air. Localised overheating of the air which could generate undesired temperature peaks on the food are thereby avoided.

[0057] Advantageously, as illustrated in particular in Figure 1, the chamber 3 comprises a bottom wall 6, which the foods to be treated are laid directly or indirectly on and which is traversed by a plurality of grooves 6a to enable the air A to also circulate under the foods.

[0058] Advantageously, the device 1 comprises a control unit (not shown in the appended Drawings) able to control and manage the functioning of the cold generating means, the heat generating means and the ventilation means so as in particular to automatically implement the method for treating food according to the present invention. Preferably, the device comprises a temperature probe (not shown in the appended Drawings) inside the chamber 3 and a user interface 40 to programme the control unit.

[0059] The method for treating food according to the present invention will now be described. The same reference numerals will be used for the technical elements in common with the device previously described without by so doing necessarily limiting oneself to the
characteristics of said device.

[0060] According to a general form of implementation, the method for treating food according to the present invention comprises first of all an operative step a) of preparing a closed chamber 3 destined to receive the food to be treated inside it. Cold generating means 10 comprising a refrigerator circuit provided with at least one evaporator 11, heat generating means 20 and ventilation means 30 able to generate a circulation of air A affecting the chamber, the evaporator 11 and heat generating means 20, being associated with said chamber 3.

[0061] Advantageously, the method according to the invention may be implemented using in particular the device 1 for the treatment of food as described above, even though implementation is possible using other devices having the essential characteristics indicated in step a) of the method.

[0062] Again according to the aforesaid general form of implementation, the method comprises at least one step b) of thermically treating the food inside the aforesaid chamber 3 supplying heat in a controlled manner such as to keep the air temperature of the chamber 3 within a predefined value range ΔT1. The heat is supplied in a controlled manner alternating, with or without
intermediate interruptions:

[0063] - sub-steps b(1) of supplying heat, in which the heat generating means and ventilation means are simultaneously operative,

[0064] - sub-steps b(2) of removing heat, in which the cold generating means and ventilation means are simultaneously operative, depending on the course of the real temperature in the chamber in relation to said predefined value range (ΔT1).

[0065] Diversely from what is envisaged in the prior art, the method according to the present invention permits a much more accurate regulation of the temperature inside the chamber 3 given that it permits adjustment of the thermic state not just by providing heat but also by removing heat so as to be less constrained by the thermic inertia of the system.

[0066] Operatively, the alternation of the sub-steps b(1) of providing heat and the sub-steps b(2) of removing heat and the duration of the single sub-steps are aimed at keeping the temperature of the chamber at least within a predefined value range for a predefined period of time.

[0067] The temperature range and the period of time can be set depending on the type of food and on the purposes of thermic treatment, as will be explained further below.

[0068] According to a preferred form of implementation, the
step b) of thermic treatment comprises at least one sub-step b3) of restoring the level of humidity inside the chamber 3 by activating the ventilation means subsequently to at least one sub-step b2) of removing heat. The ventilation is aimed at removing the humidity collected on the exchange surface of the evaporator 11 during the previous step b2) of removing heat and at re-dispersing such humidity inside the chamber 3.

[0069] Preferably, the step b) of thermic treatment envisages a sequential alternation of sub-steps b1) of supplying heat, sub-steps b2) of removing heat and sub-steps b3) of restoring humidity depending on the predefined temperature value inside the chamber and the predefined treatment times of the food. Advantageously, it is therefore possible to envisage that each sub-step b2) of removing heat is always automatically followed by a sub-step b3) of restoring humidity.

[0070] Advantageously, during the sub-step b3) of restoring the level of humidity, the ventilation means are kept activated while keeping both the heat generating means and heat removing means deactivated.

[0071] According to a particularly preferred form of implementation, the chamber 3 communicates with a first technical compartment in which the heat generating means, the evaporator and the ventilation means are housed. The
chamber and the first technical compartment form a hermetically closed volume affected by the air circulation A. This makes it possible to keep the humidity which may be released by the food during thermic treatment inside this hermetically closed volume (chamber 3 and first technical compartment 4) thereby permitting its complete redistribution on the food during said thermic treatment. Thanks to this method, humidity is neither added nor removed from the chamber 3. It is therefore possible to treat the food duly restoring it to a condition of equilibrium as far as the content of air humidity is concerned. The persistence of humidity gradients which tend to dry out food is thereby avoided.

[0072] This way the humidity inside the chamber need no longer be monitored. Thereby avoiding the need to adopt complex detection and control means and envisage a reintegration of the humidity, with all the associated drawbacks.

[0073] In the sub-step b3) of restoring the level of humidity the ventilation means can function continuously or at intervals.

[0074] Advantageously, the method of treatment according to the invention may comprises two or more steps b) of thermic treatment

[0075] Such two or more steps b) of thermic treatment may
be conducted in a differentiated manner from each other at least as regards the temperature conditions to be maintained inside the chamber 3.

[0076] Preferably, said cooking steps b) envisage regular restoring of the level of humidity inside the chamber 3.

[0077] A step b) of thermic treatment may be conducted to cook the food.

[0078] Preferably, in such cooking step b) the air temperature in the chamber is maintained within the range of +70°C and +80°C, except for transitory transition phases. It is thus possible to use so-called low temperature cooking procedures, ideal for example for cooking beef, (veal, beef), white meats (chicken and turkey, in particular the breast, and rabbit, in particular if boned), pork, fish, in particular cephalopods (octopus, cuttlefish, white octopus and squid, after vacuum-packing), crustaceans (after vacuum-packing after removal of shells), fish in general (salmon, sea bass, gilthead seabream, etc.).

[0079] Low temperature cooking which can be achieved with the method and the device according to the present invention brings out the flavour of the food in a highly evident manner with reduced use of spices or seasoning. The tenderness for example of roast beef cooked this way bears no relation to traditional or microwave cooking
inasmuch as being non-aggressive it does not remove the liquids contained in the food itself as well as ensuring accurate control of the temperature.

[0080] Figure 7 shows an example of the possible course of the air temperature over time inside the food treatment chamber during a step b) of low temperature cooking treatment. Excluding the transitory phase of rapid raising of the temperature (in the example shown the food was initially at a cold preservation temperature of around +2°C), in the stable phase around 70°C the oscillation reflecting the alternation of steps of providing and removing heat and restoring humidity can be seen).

[0081] A step b) of thermic treatment can be conducted to regenerate pre-cooked foods so as to restore the foods to the thermic conditions suitable for eating. The control of humidity which the present method permits implementation of, makes the regeneration (or reviving) treatment very delicate or absolutely non-aggressive, given that the temperature in the chamber can be accurately controlled (avoiding undesirable peaks) and in addition, the removal of humidity from the pre-cooked food is reduced to a minimum if not entirely cancelled.

[0082] Preferably, in such regenerative step b) the air temperature in the chamber is maintained within the range
of +60°C and 70°C, and even more preferably between +65°C and +70°C.

[0083] Figure 8 shows an example of the possible course of the air temperature over time inside the food treatment chamber during a step b) of regenerative treatment. Excluding the transitory phase of rapid raising of the temperature (in the example shown the food was initially at a cold preservation temperature of around +2°C), in the stable phase around 70°C the oscillation reflecting the alternation of steps of providing and removing heat and restoring humidity can be seen. In the example, the regenerative step is followed by a step of hot preservation treatment at about 60°C.

[0084] A step b) of thermic treatment can be conducted to preserve pre-cooked foods in thermic conditions suitable for eating. This step in particular could be performed without envisaging a regular restoring of the humidity inside the chamber.

[0085] Preferably, in such regenerative treatment step b) the air temperature in the chamber 3 is maintained within the range of +55°C and 65°C, and even more preferably between +60°C and +65°C. At these temperatures and thanks to the regular restoring of humidity, it is possible to keep the food in thermic conditions suitable for eating even for indefinite periods of time, without
the cooking process altering the nutritive and organoleptic properties of the pre-cooked food.

[0086] A step b) of thermic treatment may be conducted to defrost frozen or deep-frozen food. This step too preferably envisages the regular restoring of the level of humidity inside the chamber 3 so as to make the defrosting on the one hand as fast as possible and on the other as non-aggressive as possible as regards the extraction of humidity.

[0087] Preferably, in such defrosting step b) the air temperature in the chamber is maintained within the range of +15°C and +25°C.

[0088] Figure 10 shows an example of the possible course of the air temperature over time inside the food treatment chamber during a defrosting step b). Excluding the transitory phase of rapid raising of the temperature (in the example the food was initially at a preservation temperature in the freezer of around -20°C), in the stable phase around 25°C the oscillation reflecting the alternation of steps of providing and removing heat and restoring humidity can be seen. In the example, the regenerative step is followed by a step of cold preservation treatment at about +2°C, using a possible operating mode which will be described further below.

[0089] The method and the device according to the invention
thereby make controlled defrosting of the food possible, reaching the correct core temperature without "cooking" the food internally as happens instead for example with a microwave oven. The controlled raising of the temperature in various steps (and the regular restoring of humidity) assures a reduced loss of liquid from the food, needed during the cooking step to maintain the flavour of the product and its natural tenderness.

[0090] A step b) of thermic treatment may be conducted to raise dough. This step too preferably envisages the regular restoring of the level of humidity inside the chamber 3.

[0091] Preferably, in such raising step b) the air temperature in the chamber is maintained within the range of +20°C and +35°C, ideal for enabling the activation and action of the yeasts.

[0092] Considering the fact that raising requires controlled temperatures and humidity, the method and device according to the invention thereby permit correct raising at any time of year.

[0093] Figure 9 shows an example of the possible course of the air temperature over time inside the food treatment chamber during a raising step b). Excluding the transitory phase of rapid raising of the temperature, (in the example the food was initially at a cold preservation
temperature of around +5°C), in the stable phase around 26°C the oscillation reflecting the alternation of steps of providing and removing heat and restoring humidity can be seen. In the example, the regenerative step is followed by a step of cold preservation treatment at about +10°C, using a possible operating mode which will be described further below.

[0094] According to a particularly preferred form of implementation, the method of treating food according to the invention may comprise at least one step c) of cooling the air temperature of the chamber 3 so as to bring it or keep it at temperatures of not more than +10°C, and preferably not more than +3°C. Operatively, such cooling step c) envisages activation at least of the heat removing means and of the ventilation means.

[0095] Advantageously, such at least one cooling step c) may be performed either before or after the aforesaid at least one step b) of thermic treatment, depending on the operative needs of the user.

[0096] Advantageously, as will be described further below, varied sequences and combinations of such steps b) of thermic treatment and c) of cooling may in fact be envisaged.

[0097] A cooling step c) may be conducted to keep foods which are already cold at temperatures of not more than
+10°C and preferably not more than +3°C. For example, to preserve defrosted or rapidly chilled foods (as described below).

[0098] A cooling step c) may be conducted to rapidly lower the temperatures of hot foods bringing them in a short time to have core temperatures of not more +3°C.

[0099] Preferably, in such rapid chilling step c) the air temperature in the chamber is maintained within the range of -2°C and +0°C.

[00100] Figure 11 shows an example of the possible course of the air temperature over time inside the food treatment chamber during a rapid chilling step c). The initial transitory phase characterised by a temperature peak is related to the fact that the hot product placed in the chamber 3 (at about 70°C) raised the average air temperature, rapidly lowered by the continued intervention of the cold generating means. In the example, the rapid chilling step is followed by a step of cold preservation at about +2°C.

[00101] A cooling step c) may be conducted to freeze the food, bringing it to a temperature of not more than -18°C.

[00102] Preferably, in such freezing step b) the air temperature in the chamber is maintained within the range of -20°C and -40°C.
[00103] Figure 12 shows an example of the possible course of the air temperature over time inside the food treatment chamber during a freezing step c). The initial transitory phase characterised by a temperature peak is due to the initial and temporary heating of the chamber caused by the introduction of a hot food. In the example, the freezing step is followed by a step of preservation below zero at about -20°C.

[00104] Advantageously, the method of treatment according to the invention may comprises one or more cooling steps c) and one or more steps b) of thermic treatment, conducted according to a plurality of predefined and/or programmable sequences depending on predefined temperature conditions and/or time settings, in order to treat the food, preserving it inside the chamber 3 at all times in ideal conditions from a hygienic-health point of view, avoiding the permanence of the food in environmental conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of the nutritional and organoleptic characteristics of the food.

[00105] The expression “permanence in environmental conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of the nutritional and organoleptic characteristics” is not inclusive of any
short and inevitable transitory phases in which the food and the air inside the chamber pass rapidly from the "cold safety band" (T< +10°C) to the "hot safety band" (T> +55°C).

[00106] By way of example a comparison is made between the situation occurring thanks to the invention and the situation occurring traditionally in the passage from the "hot safety band" to the "cold safety band". In the case of traditional type cooling in the refrigerator, after cooking the food is made to cool from the cooking temperature to room temperature and after being thus cooled is placed in the refrigerator. In this case the food is effectively maintained in conditions favourable to bacterial proliferation for the entire time needed to cool to room temperature (which normally takes 2-3 hours). Conversely, thanks to the invention, after cooking the food can be made to remain in the "hot safety band" (hot preservation) and/or be rapidly brought to the "cold safety band" with rapid cooling of the temperature, as shown in Figure 11, without ever coming out of the chamber 3. The food transits (and therefore at no time remains) in the non safety zone for a short transitory period, which as can be seen in Figure 1 lasts to the orders of about ten minutes. An analogous situation occurs in the opposite direction, from cold to
hot, where the problem of bacterial proliferation is however not felt given that the thermic treatment eliminates any bacterial load present.

[00107] With particular reference to the aforesaid conditions of bacterial proliferation, the aforesaid one or more steps b) of thermic treatment (low temperature cooking and/or regeneration and/or defrosting and/or hot conservation) may be set to keep the air temperature inside the chamber 3 at values of not less than 55°C, preferably at values of not less than 60°C and even more preferably at values of not less than 65°C.

[00108] With particular reference to the aforesaid conditions of bacterial proliferation, the aforesaid one or more cooling steps c) (cold conservation and/or rapid chilling and/or freezing) may be set to keep the air temperature inside the chamber at values of not more than 10°C, preferably at values of not more than 5°C and even more preferably at values of not more than 3°C.

[00109] Advantageously, the temporal sequence of the steps, the duration of each single step and the temperature values correlated to each single step can be programmed by means of an electronic control unit connected to the chamber 3, to the cold generating means 10, the heat generating means 20, the ventilation means 30 and to at least one temperature probe associated with
the chamber 3.

[00110] Advantageously, the method may envisage that at the end of a step b) of thermic treatment of whatever type, after a predetermined delay time $\Delta t_d$ and/or upon reaching a threshold temperature $T_t$, a cooling step c) is automatically activated, such as a step of rapid temperature chilling and subsequent cold preservation.

[00111] The advantages of application in the domestic field of the method and device according to the invention are evident from the following example. In the morning before going to work the user removes a quantity of meat from the freezer or refrigerator and puts it in the chamber 3 for cooking. The device 1 can be programmed to keep the product at a temperature of $+3^\circ C$ for a preset period of time (step c) of cold preservation), at the end of which the cooking step b) may begin. After a certain period of time (such as 3-4 hours) the meat is ready. The device 1 can be programmed to keep the food hot so as to be eaten immediately (step b) of hot preservation). The device may even already be programmed to rapidly chill the food to $+3^\circ C$ (rapid chilling step c) in the case in which for any reason the food is not removed from the chamber 3 after a preset period of time.

[00112] From the example shown it is clear how the food may in addition always be treated in ideal conditions
from a hygienic-health point of view, avoiding permanence in environmental conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of the nutritional and organoleptic characteristics.

[00113] The example above is purely for the purposes of illustration and non-limiting, numerous and varied combinations of cooling steps c) and thermic treatment steps b) being possible, depending on the varying needs of the user.

[00114] The invention permits numerous advantages to be achieved in part already described.

[00115] The method and the device according to the invention enable thermic treatments to be performed of food requiring accurate temperature control, and eventually control of the humidity so as to reduce the aggressiveness of food preparation.

[00116] The method and the device in particular make it possible to treat and to preserve food at all times in ideal conditions from a hygienic-health point of view, avoiding the permanence of such foods in environmental conditions favourable to the proliferation of bacteria and/or in any case favourable to loss of the nutritional and organoleptic characteristics.

[00117] The method for treating food according to the
present invention can be implemented in a simple and immediate manner. In particular, humidity control proves operatively very simple to manage.

[00118] The device for treating food according to the present invention is in addition simple to construct and thereby easy and economical to produce.

[00119] The invention thus conceived achieves the predefined objectives.

[00120] Obviously in its practical form it may assume forms and configurations different from those illustrated while remaining within the present field of protection.

[00121] Moreover, all the parts may be replaced by technically equivalent elements and the dimensions, forms and materials used may be varied as needed.
Claims

1. Method for treating food, comprising the following operating steps:
- a step a) of preparing a closed chamber destined to receive the food to be treated inside it, cold generating means comprising a refrigerator circuit provided with at least one evaporator, heat generating means and ventilation means able to generate a circulation of air affecting the chamber, the evaporator and heat generating means, being associated with said chamber;
- at least one step b) of thermically treating the food inside the chamber supplying heat in a controlled manner such as to keep the air temperature of the chamber within a predefined value range (ΔT1) over +10°C, alternating, with or without intermediate interruptions, sub-steps b1) of supplying heat, in which the heat generating means and ventilation means are simultaneously operative, with sub-steps b2) of removing heat in which the cold generating means and ventilation means are simultaneously operative, depending on the course of the real temperature in the chamber in relation to said predefined value range (ΔT1).

2. Method according to claim 1, wherein said step b) of thermic treatment comprises at least one sub-step b3) of restoring the level of humidity inside the chamber by activating the ventilation means subsequently to at least
one sub-step b2) of removing heat, the ventilation being aimed at removing the humidity collected on the exchange surface of the evaporator during the previous step b2) of removing heat and at re-dispersing such humidity inside the chamber.

3. Method according to claim 2, wherein during the sub-step b3) of restoring the level of humidity, the ventilation means are kept activated while keeping both the heat generating means and heat removing means deactivated.

4. Method according to claim 2 or 3, wherein said chamber communicates with a first technical compartment which the heat generating means, the evaporator and the ventilation means are housed in, the chamber and the first technical compartment forming a hermetically closed volume affected by said air circulation.

5. Method according to claim 2, 3 or 4, wherein said step b) of thermic treatment envisages a sequential alternation of sub-steps b1) of supplying heat, sub-steps b2) of removing heat and sub-steps b3) of restoring humidity depending on the predefined temperature value inside the chamber and the predefined treatment times of the food.

6. Method according to one or more of the claims from 2 to 5, wherein in said sub-step b3) of restoring the level
of humidity the ventilation means function continuously or at intervals.

7. Method according to one or more of the previous claims, comprising one or more steps b) of thermic treatment, it being possible to conduct said more steps b) of thermic treatment in a differentiated manner from each other at least as regards the temperature conditions to be maintained inside the chamber.

8. Method according to one or more of the previous claims, wherein a step b) of thermic treatment can be conducted to cook the foods, said step b) of cooking treatment preferably envisaging regular restoring of the level of humidity inside the chamber, in said cooking step b) the air temperature in the chamber being preferably maintained within the range of +70°C and +80°C.

9. Method according to one or more of the previous claims, wherein a step b) of treatment can be conducted to regenerate pre-cooked foods so as to restore the foods to the thermic conditions suitable for eating, said step b) of regenerative treatment preferably envisaging regular restoring of the level of humidity inside the chamber, in said regenerative step b) the air temperature in the chamber being preferably maintained within the range of +60°C to 70°C, and even more preferably of +65°C.
to +70°C.

10. Method according to one or more of the previous claims, wherein a step b) of treatment may be conducted to preserve pre-cooked foods in thermic conditions suitable for eating, said step b) of preservation treatment preferably envisaging regular restoring of the level of humidity inside the chamber, in said regenerative step b) the air temperature in the chamber being preferably maintained within the range of +55°C to 65°C, and even more preferably of +60°C to +65°C.

11. Method according to one or more of the previous claims, wherein a step b) of treatment may be conducted to raise dough, said step b) of raising treatment preferably envisaging regular restoring of the level of humidity inside the chamber, in said raising step b) the air temperature in the chamber being preferably maintained within the range of +20°C to 35°C.

12. Method according to one or more of the previous claims, wherein a step b) of treatment may be conducted to defrost frozen or deep-frozen foods, said step b) of defrosting treatment preferably envisaging regular restoring of the level of humidity inside the chamber, in said defrosting step b) the air temperature in the chamber being preferably maintained within the range of +15°C and +25°C.
13. Method according to one or more of the previous claims, comprising at least one step c) of cooling the air temperature of the chamber bringing it and/or keeping it at temperatures of not more than +10°C, and preferably not more than +3°C, said cooling step c) envisaging activation at least of the heat removing means and of the ventilation means.

14. Method according to claim 13, wherein a step c) of cooling may be conducted to keep foods which are already cold at temperatures of not more than +10°C and preferably not more than +3°C.

15. Method according to claim 13 or 14, wherein a step c) of cooling may be conducted to rapidly cool the temperature of hot foods, bringing them to have in a short time core temperatures not greater than +3°C, in said rapid cooling step c) the air temperature in the chamber being maintained preferably in the range of -2°C to 0°C.

16. Method according to one or more of the claims from 13 to 15, wherein a cooling step c) may be conducted to freeze foods, bringing them to temperatures not greater than -18°C, in said freezing step c) the air temperature in the chamber being maintained preferably in the range of -20°C to -40°C.

17. Method according to one or more of the claims from
13 to 16, comprising one or more steps c) of cooling and one or more steps b) of thermic treatment, conducted according to a predefined sequence, said one or more steps b) of thermic treatment being set to keep the air temperature inside the chamber at values of not less than 55°C, said one or more steps c) of cooling being set to keep the air temperature inside the chamber at values of not more than 10°C.

18. Method according to claim 17, wherein the temporal sequence of the steps, the duration of each single step and the temperature values correlated to each single step can be programmed by means of an electronic control unit connected to the chamber, to the cold generating means, the heat generating means, the ventilation means and to at least one temperature probe associated with the chamber.

19. Device for treating food, comprising:
- a chamber (3) destined to receive the food to be treated inside it;
- cold generating means (10) comprising a refrigerating circuit provided with at least one evaporator (11), a compressor (12) and a condenser (13);
- heat generating means (20); and
- ventilation means (30) generating a circulation of air (A) which affects the chamber (3), the evaporator (11)
and the heat generating means (20),
said device (1) comprising a first technical compartment (4), fluidically communicating with the chamber (3), in which the heat generating means (20), the evaporator (11) and the ventilation means (30) are housed, and a second technical compartment (5) thermically insulated from said first compartment (4) and from said chamber (3) in which the compressor (12) and condenser (13) are housed.

20. Device according to claim 19, wherein said chamber (3) and said first technical compartment (4) form a hermetically closable volume, affected by said air circulation (A).

21. Device according to claim 19 or 20, wherein said evaporator (11) is a finned tube heat exchanger and said heat generating means (20) comprise at least one resistor thermically connected to said finned tube heat exchanger.

22. Device according to one or more of the claims from 19 to 21, wherein said chamber comprises a bottom wall (6), which the foods to be treated are laid directly or indirectly on and which is traversed by a plurality of grooves (6a) to enable the air to also circulate under the foods.

23. Device according to one or more of the claims from 19 to 22, comprising an access door (7) to the chamber (3) and a hermetic sealing gasket (9) positioned in the
abutment zone of the door (7) on the structure (2) of said device, said device (1) being preferably provided with magnetic means (8) positioned opposite the hinging area of said door (7) to hold it closed and compress said gasket (9).

24. Device according to one or more of the claims from 19 to 23, comprising a control unit able to implement the method according to any of the claims from 1 to 18, said device comprising at least one temperature probe inside the chamber (3) and a user interface (40) for programming said control unit.
INTERNATIONAL SEARCH REPORT

According to International Patent Classification (IPC) or to both national classification and IPC

A. CLASSIFICATION OF SUBJECT MATTER
INV. A21D17/00 A23L1/01 F25D17/06 F25D31/00
ADD.

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A21D A23L F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, BIOSIS, FSTA, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search
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Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-0400,
Fax. (+31-70) 340-3016

Authorized officer
Heirbaut, Marc
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