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(54) **SYSTEM, APPARATUS AND METHOD FOR COOLING DOWN MATERIAL/INGREDIENTS**

(57) The invention related to a system (100) for cooling down ingredients (I). The system (100) comprises a container (102) for receiving the ingredients (I); a shell (101) surrounding the container (102); the container (102) and the shell (101) being arranged to form a chamber (103) in between; zeolite material (104) arranged in the chamber (103); an inlet (105) opening in the chamber (103), the inlet (105) being adapted to receive water to be poured on the zeolite material (104). The invention also relates to an apparatus for cooking ingredients (I) and a corresponding method for cooling down ingredients (I).

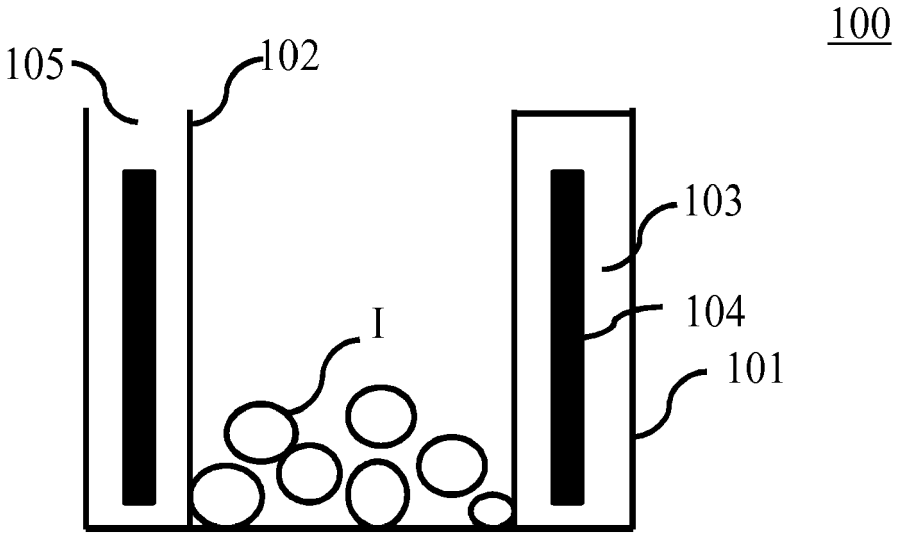

FIG.1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to the field of cooling down material/ingredients, in particular food ingredients. The invention, for example, can be used in a kitchen appliance.

BACKGROUND OF THE INVENTION

[0002] Home-use cooking devices for various applications are well known. E.g. rice cookers, multicookers, pressure cookers, air-based fryers, slow cookers, different types of ovens like microwave ovens, steaming ovens and the like.

[0003] There are needs that ingredients, for example, food ingredients, which have been heated in a cooking appliance, have to be cooled down at the end of the cooking cycle, which takes quite some time if ingredients simply cool down in a room temperature environment. One reason to the need of bringing down the temperature of ingredients is that the food has to be consumed at a lower temperature than the cooking temperature, e.g. pudding. A second reason is that a user wants to store the food before consuming the food, e.g. placing the food in a storage cabin, refrigerator or freezer. Therefore the food has to be brought down to room temperature. A third reason is to remain, especially for food that is only heated for short period of time, as much as possible nutrients that are sensitive to heat.

[0004] To cool down the food, the known approach is to add an active energy-consuming cooling means, for example a Peltier element for thermo-electric cooling or a heat pump for vapor-compression refrigeration, to make such a cooling function possible. However, the approach requires first heating up food and later on adding more energy to remove the heat, which is a waste of energy.

[0005] The known approach still has some problems. Firstly, as indicated, the cooling means needs to use extra energy to remove the heat from the food. Secondly the cooling means occupies extra space in a cooking appliance and make the cooking appliance thereby bigger in size.

OBJECT AND SUMMARY OF THE INVENTION

[0006] The object of the invention is to provide an improved system for cooling down ingredients which mitigate and/or alleviate the above-mentioned problems.

[0007] According to a first aspect of the present invention, a system for cooling down ingredients is provided. The system comprises:

- a container for receiving the ingredients;
- a shell surrounding the container;
- the container and the shell being arranged to form a chamber in between;
- zeolite material arranged in the chamber; and
- an inlet opening in the chamber, the inlet being adapted to receive water to be poured on the zeolite material.

[0008] Having zeolite material filled-in the chamber allows the zeolite material absorbing energy to induce a cooling effect when water is poured into the chamber and absorbed by the zeolite material. Thus the temperature of the zeolite material and the chamber go down. Consequently, due to thermal exchange between the chamber and the container, the container also cools down which in sequence cools down the ingredients in the container. Therefore, this cooling solution does not require extra energy to remove the heat from the ingredients.

[0009] Arranging the chamber between the container and the shell enables using an existing space for holding the zeolite material, which does not require extra space in the system. Therefore this solution does not require increasing the size of the system.

[0010] In another embodiment of the system according to the present invention, further comprising a first heating element for heating the zeolite material.

[0011] The first heating element for heating the zeolite material allows dehydrating the zeolite material. Therefore, the zeolite material is prepared for the next cooling application.

[0012] In another embodiment of the system according to the present invention, further comprising a peripheral wall surrounding the zeolite material for separating the zeolite material with the shell and the container.

Having the peripheral wall allows holding the zeolite material within the peripheral wall. It enables an independent cooling unit including the zeolite material, which allows convenient integration with other parts of the system.

[0013] In another embodiment of the system according to the present invention, the chamber comprises an outlet to allow water evaporating from the zeolite material to exit the chamber.

[0014] The outlet allows removing water evaporating from the zeolite material out of the chamber, which in sequence removes unnecessary moisture in the chamber and pressure induced by water evaporating from the zeolite material.

[0015] In another embodiment of the system according to the present invention, further comprising a water container fluidly connected to the inlet for pouring water on the zeolite material.

[0016] Having the water container allows storing water to enable cooling without inducing extra water, which is convenient for users.

[0017] In another embodiment of the system according to the present invention, the water container is located above the inlet.

[0018] The water container locating above the inlet allows water in the water container flowing into the chamber directly due to water gravity.

[0019] In another embodiment of the system according to the present invention, the water container comprises a valve component for regulating the circulation of water from the water container through the inlet.

[0020] The valve component allows controlling the circulation of water, which in sequence controls the status of cooling by pouring water on the zeolite material in the chamber.

[0021] In another embodiment of the system according to the present invention, the water container further comprises a controller for controlling the opening of the valve component.

[0022] Having the controller allows controlling the status of the valve component automatically.

[0023] In another embodiment of the system according to the present invention, further comprises:

- a channel fluidly connecting the outlet to the water container, for circulating water evaporated from the outlet; and
- a condensing unit for condensing the evaporated water circulating in the channel, the channel being adapted to collect condensate water back to the water container.

[0024] Having the channel allows providing a route for water evaporated to circulate from the outlet to the water container. The condensing unit to condensing the water evaporated and the channel to collect condensed water back to the water container allow reusing the water for the next cooling application.

[0025] In another embodiment of the system according to the present invention, the condensing unit is arranged adjacent to a portion of the channel inclined downwards towards the water container.

[0026] aving the condensing unit adjacent to a portion of the channel inclined downwards towards the water container allows condensate water flowing into the water container through the channel.

[0027] According to a second aspect of the present invention, an apparatus for cooking ingredients is provided comprising:

- a system as claimed in any one of the proceeding claims; and
- a second heating element for heating the container.

[0028] According to a third aspect of the present invention, a method for cooling down ingredients in a system comprising a container intended to receive the ingredients and having a shell surrounding the container and where zeolite material is arranged between the container and the shell is provided comprising the step of:

- pouring water on the zeolite material.

[0029] In another embodiment of the method according to the present invention, further comprising the step of:

-heating the zeolite material to evaporate water contained in the zeolite material.

[0030] In another embodiment of the method according to the present invention, further comprising the steps of:

- condensing the evaporated water;
- collecting the resulting condensate water in a water container.

[0031] In another embodiment of the method according to the present invention, the step of pouring water comprising the steps of:

- pouring water from the water container;
- controlling the flow of water poured from the water container on the zeolite material.

[0032] Detailed explanations and other aspects of the invention will be given below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Particular aspects of the invention will now be explained with reference to the embodiments described hereinafter and considered in connection with the accompanying drawings, in which identical parts or sub-steps are designated in the same manner:

Fig.1 depicts a simplified illustration of a system for cooling down ingredients in accordance with the present invention,
Fig.2 depicts a first preferred embodiment of a system according to the invention,
Fig.3 depicts a second preferred embodiment of a system according to the invention,
Fig.4 depicts a third preferred embodiment of a system according to the invention,
Fig.5 depicts a fourth preferred embodiment of a system according to the invention,
Fig.6 depicts a fifth preferred embodiment of a system according to the invention,
Fig.7 depicts an example of a channel for circulating water evaporated from a system according to the invention,
Fig.8 depicts an apparatus for cooking ingredients comprising a system according to the invention,
Fig.9 depicts a flowchart of a method in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Fig.1 depicts a simplified illustration of a system 100 for cooling down ingredients I in accordance with the present invention.

[0035] The system comprises a container 102 for receiving the ingredients I. The system also comprises a shell 101 surrounding the container 102.

[0036] The ingredients I may have various types. For example, ingredients I maybe food that has been previously cooked.

[0037] The container 102 and the shell 101 are arranged to form a chamber 103 in between. Zeolite material 104 is arranged in the chamber 103.

[0038] The chamber 103 is a space formed between the container 102 and the shell 101. In this example, the system is symmetrical around a central vertical axis, which explains why the chamber 103 and the zeolite material 104 are depicted on both sides of the container 102. However, in case the system is not symmetrical, having the chamber 103 on only one side of the container 102 is also possible.

[0039] The zeolite material 104 is a natural or synthetic mineral that has the ability to hydrate and dehydrate coupled to an absorption respectively release of energy while maintaining structural stability and therefore is used for adsorption refrigeration. When the zeolite material 104 is hydrated, the zeolite material 104 cools down and indirectly cools down the surrounding environment, for example, the container 102 and the ingredients I in the container 102.

[0040] The system also comprises an inlet 105 opening in the chamber 103, the inlet 105 being adapted to receive water to be poured on the zeolite material 104. When water is injected from the inlet 105 and poured on the zeolite material 104, the zeolite material 104 adsorbs the water and starts to cool down.

[0041] When the zeolite material 104 cools down, the temperature of the chamber 103 also goes down. Consequently, due to thermal exchange between the chamber 103 and the container 102, the container 102 also cools down which in sequence cools down ingredients I in the container 102.

[0042] Fig.2 depicts a first preferred embodiment of a system according to the invention.

[0043] Advantageously, the system further comprises a first heating element 112 for heating the zeolite material 104.

[0044] For example, the first heating element 112 is arranged under the chamber 103 with the zeolite material 104.

[0045] When the zeolite material 104 is heated by the first heating element 112, the water adsorbed by the zeolite material 104 is evaporated from the zeolite material 104. The zeolite material 104 is dehydrated.

[0046] Fig.3 depicts a second preferred embodiment of a system according to the invention.

[0047] Advantageously, the system further comprises a peripheral wall 113 surrounding the zeolite material 104 for separating the zeolite material 104 with the shell 101 and the container 102.

[0048] The zeolite material 104 is inside the peripheral wall 113 and has no contact with the shell 101 and the container 102. When water is poured on the zeolite material 104, the water and the zeolite material 104 is kept within the peripheral wall 113.

[0049] The peripheral wall 113 may also be adapted to mechanically connect to the container 102.

[0050] Having the mechanical connection between the peripheral wall 113 and the container 102 allows thermal exchange in high efficiency between the inside of the peripheral wall 113 and the container 102. When the zeolite material 104 adsorbs water, the temperature of the zeolite material 104 and the peripheral wall 113 go down. In sequence, the temperature of the container decreases quickly.

[0051] Fig.4 depicts a third preferred embodiment of a system according to the invention.

[0052] Advantageously, the chamber 103 comprises an outlet 106 to allow water evaporating from the zeolite material 104 exit to the chamber 103.

[0053] When water is evaporated from the zeolite material 104 in the chamber 103, the outlet 106 is arranged for water vapour to exit from the chamber 103. The outlet 106 intends to guide the water evaporated to ventilate to the outside.

[0054] The outlet 106 is an opening on the chamber 103, which may be a different opening with the inlet 105. The outlet 106 may also be the same opening as the inlet 105.

[0055] Fig.5 depicts a fourth preferred embodiment of a system according to the invention.

[0056] Advantageously, the system further comprises a water container 107 fluidly connected to the inlet 105 for pouring water on the zeolite material 104.

[0057] The water container 107 is used for storing water. The water in the water container 107 may be poured on the zeolite material 104 through the inlet 105.

[0058] The water container 107 maybe integrated with the shell 101. The water container 107 may further comprise an opening 114 for injecting water into the water container 107. The opening 114 is not shown in Fig.5. The opening 114 maybe closed by means of a cap to prevent water running out.

[0059] Advantageously, the water container 107 is located above the inlet 105. By this arrangement, the water in the water container 107 may flow into the chamber 103 directly through the inlet 105 because of the water gravity.

[0060] Advantageously, the water container 107 comprises a valve component 108 for regulating the circulation of water from the water container 107 through the inlet 105. The valve component 108 may be arranged in the bottom of the water container 105. The valve component 108 may also be arranged at the joint location between the water container 107 and the inlet 105.

[0061] The valve component 108 comprises at least two states. The first state of the valve component 108 is to keep the water in the water container 107. The second state of the valve component 108 is to let the water in the water container 107 flow into the chamber 103 through the inlet 105.

[0062] The valve component 108 may also be configured to control the velocity of the flow when water in the water container 107 is poured into the chamber 103. The valve component 108 may be manually opened by a user. For example, by pushing a knob down connected to the valve component 108, the valve component 108 opens and the water in the water container 107 is poured into the chamber 103.

[0063] Advantageously, the water container 107 further comprises a controller 109 for controlling the opening of the valve component 108.

[0064] The controller 109 electrically connected to the valve component 108. The controller 109 maybe arranged on the shell 101 or on the valve component 108.

[0065] The controller 109 aims to control the valve component 108 automatically. The status of the valve component 108 is controlled by the controller 109. The controller 109 may be configured to control the valve component 108 to enable the water to be kept in the water container 107 or enable the water in the water container 107 to pour into the chamber 103. The controller 109 may also be configured to control the valve component 108 to enable the water in the water container 107 to pour into the chamber 103 with a certain velocity of the flow.

[0066] The controller 109 may send a signal to the valve component 108. When the signal is received by the valve component 108, the valve component 108 is configured to set a status by following the relevant instructions of the signal.

[0067] Fig.6 depicts a fifth preferred embodiment of a system according to the invention.

[0068] Advantageously, the system further comprises:

- a channel 110 fluidly connecting the outlet 106 to the water container 107, for circulating water evaporated from the outlet 106; and
- a condensing unit 111 for condensing the evaporated water circulating in the channel 110, the channel 110 being adapted to collect condensate water back to the water container 107.

[0069] The condensing unit 111 may be arranged in the channel 110 or attached to the wall of the channel 110 from the outside.

[0070] The water is evaporated from the zeolite material 104 in the chamber 103 when the zeolite material 104 is heated. The water evaporated exits from the outlet 106 into the channel 110. The evaporated water flows within the channel 110 depending on the pressure in the channel 110.

[0071] By the condensing unit 111, the water evaporated is condensed to condensate water gradually within the channel 110. The condensate water flows in the channel 110 and is guided to the water container 107 by the channel 110.

[0072] Advantageously, the condensing unit 111 is arranged adjacent to a portion of the channel 110 inclined downwards towards the water container 107.

[0073] Fig.7 depicts an example of a channel for circulating water evaporated from a system according to the invention.

[0074] As illustrated in Fig. 7, the portion A of the channel 110 is connected to the outlet 106. The portion B of the channel 110 is connected to the water container 107.

[0075] The condensing unit 111 is arranged adjacent to a portion of the channel 110 inclined downwards towards the water container 107, as illustrated in Fig. 7. The water evaporated is condensed by the condensing unit 111 in the channel 110 first and then the condensate water flows into the water container 107 along the channel 110 due to gravity.

[0076] Fig.8 depicts an apparatus for cooking ingredients comprising a system according to the invention.

[0077] The apparatus 200 comprises a system 100 and a second heating element 201 for heating the container 102.

[0078] The second heating element 201 aims to heat the container 102 and in sequence heat the ingredients I in the container 102.

[0079] The second heating element 201 maybe the same as the first heating element 112. In this case, the ingredients I in the container 102 are heated and in sequence the zeolite material 104 in the chamber 103 is heated.

[0080] For a next cooking application, ingredients I are heated. Meanwhile, the water in the zeolite material 104 is evaporated by being heated. The water evaporated is guided and exits through the outlet 106 from the chamber 103. This process does not have any impact to the next cooking process.

[0081] Fig.9 depicts a flowchart of a method in accordance with the present invention.

[0082] The method 300 for cooling down ingredients I in a system comprising a container intended to receive the ingredients I and having a shell surrounding the container and where zeolite material 104 is arranged between the container and the shell, comprises the step of pouring 301 water on the zeolite material 104.

[0083] When water is poured on the zeolite material 104, the zeolite material absorbs the water and starts to cool down.

[0084] Advantageously, the method 300 further comprises the step of heating 302 the zeolite material 104 to evaporate water contained in the zeolite material 104.

[0085] When the zeolite material 104 is heated, the water absorbed in the zeolite material 104 is evaporated. Therefore, the zeolite material 104 is dehydrated.

[0086] Advantageously, the method 300 further comprises the steps of:

- condensing 303 the evaporated water;
- collecting 304 the resulting condensate water in a water container.

[0087] The evaporated water is condensed to condensate water. And the condensate water is collected back

into the water container.

[0088] Advantageously, the step of pouring 301 comprises the steps of:

- pouring water from the water container;
- controlling the flow of water poured from the water container on the zeolite material 104. The pouring of water in the water container is able to be controlled by a valve component.

[0089] The above embodiments as described are only illustrative, and not intended to limit the technique approaches of the present invention. Although the present invention is described in details referring to the preferable embodiments, those skilled in the art will understand that the technique approaches of the present invention can be modified or equally displaced without departing from the protective scope of the claims of the present invention. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A system (100) for cooling down ingredients (I), said system (100) comprising:

- a container (102) for receiving said ingredients (I);
- a shell (101) surrounding said container (102);
- said container (102) and said shell (101) being arranged to form a chamber (103) in between;
- zeolite material (104) arranged in said chamber (103); and
- an inlet (105) opening in said chamber (103), the inlet (105) being adapted to receive water to be poured on said zeolite material (104).

2. A system (100) as claimed in any one of preceding claims, further comprising

- a first heating element (112) for heating said zeolite material (104).

3. A system (100) as claimed in claim 1, further comprising a peripheral wall (113) surrounding said zeolite material (104) for separating said zeolite material (104) with said shell (101) and said container (102).

4. A system (100) as claimed in claim 1, wherein said chamber (103) comprises an outlet (106) to allow water evaporating from said zeolite material (104) to exit said chamber (103).

5. A system (100) as claimed in claim 1, further comprising a water container (107) fluidly connected to said inlet (105) for pouring water on said zeolite material (104).

6. A system (100) as claimed in claim 5, wherein said water container (107) is located above said inlet (105).

7. A system (100) as claimed in claim 5, wherein said water container (107) comprises a valve component (108) for regulating the circulation of water from said water container (107) through said inlet (105).

8. A system (100) as claimed in claim 7, wherein said water container (107) further comprises a controller (109) for controlling the opening of said valve component (108).

9. A system (100) as claimed in claim 5, further comprises:

- a channel (110) fluidly connecting said outlet (106) to said water container (107), for circulating water evaporated from said outlet (106); and
- a condensing unit (111) for condensing said evaporated water circulating in said channel (110), said channel (110) being adapted to collect condensate water back to said water container (107).

10. A system (100) as claimed in claim 9, wherein said condensing unit (111) is arranged adjacent to a portion of said channel (110) inclined downwards towards said water container (107).

11. An apparatus (200) for cooking ingredients (I), said apparatus comprising:

- a system (100) as claimed in any one of the proceeding claims; and
- a second heating element (201) for heating said container (102).

12. A method (300) for cooling down ingredients (I) in a system comprising a container intended to receive said ingredients (I) and having a shell surrounding said container and where zeolite material (104) is arranged between said container and said shell, said method (300) comprising the step of:

- pouring (301) water on said zeolite material (104).

13. A method (300) as claimed in claim 12, further comprising the step of:

- heating (302) said zeolite material (104) to

evaporate water contained in said zeolite material (104);

14. A method (300) as claimed in claim 13, further comprising the steps of:

- condensing (303) said evaporated water;
- collecting (304) the resulting condensate water in a water container.

15. A method (300) as claimed in claim 12, or 14, wherein said step of pouring (301) comprising the steps of:

- pouring water from said water container,
- controlling the flow of water poured from said water container on said zeolite material (104).

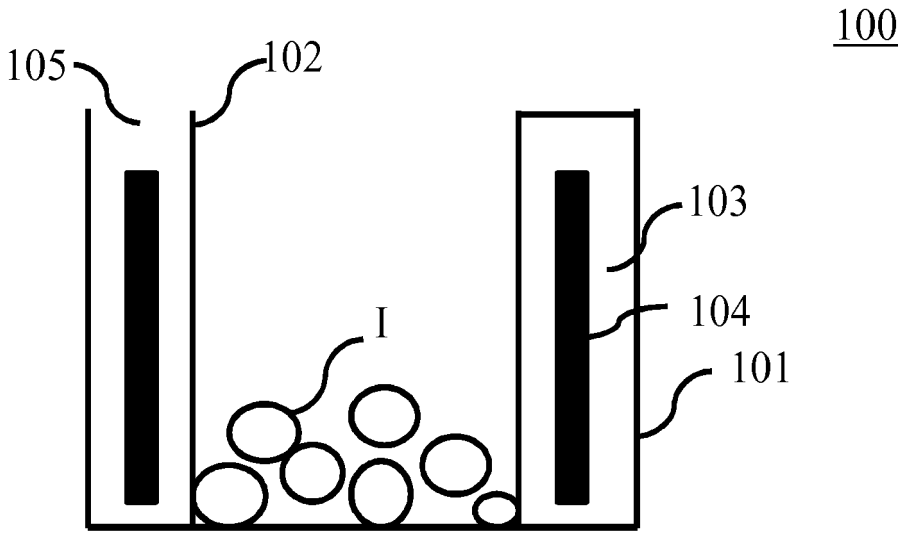

FIG.1

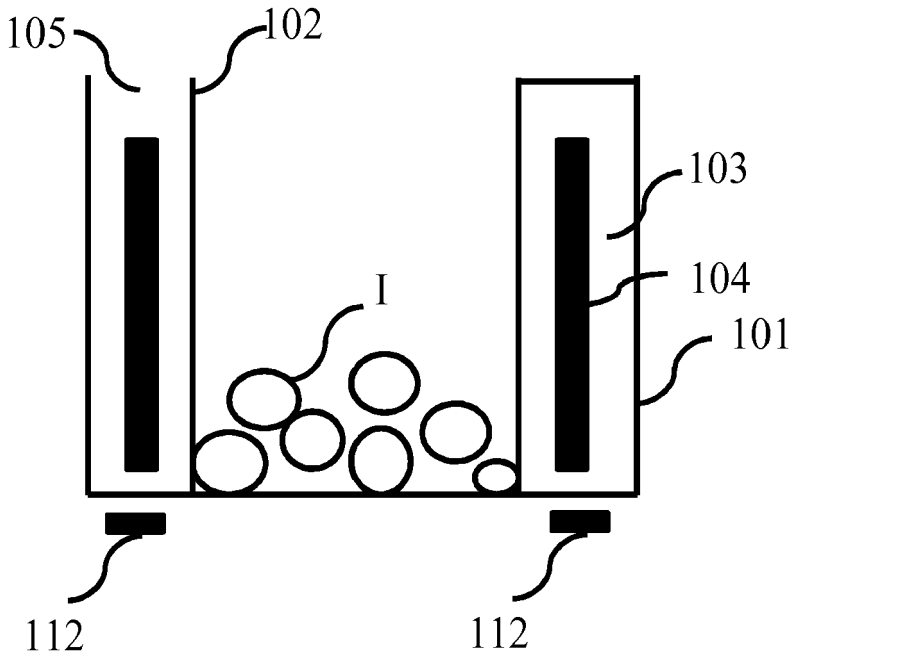

FIG.2

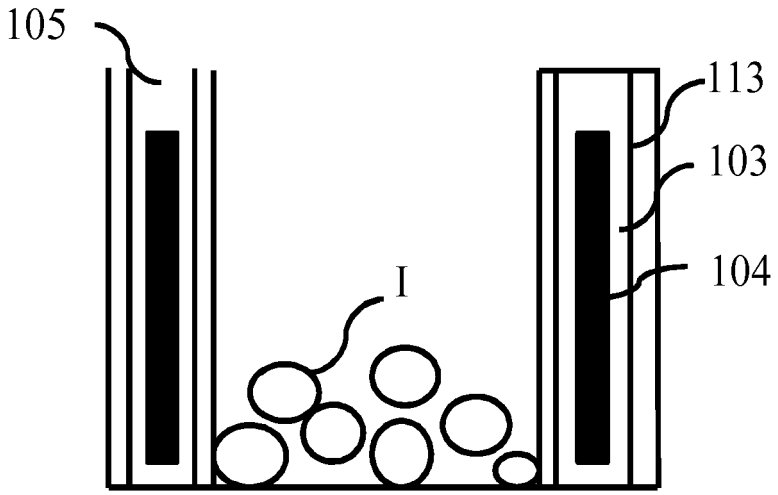

FIG.3

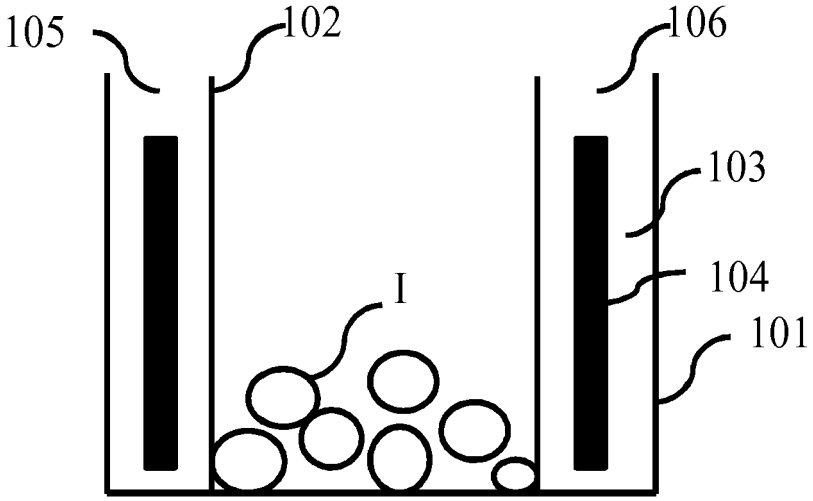

FIG.4

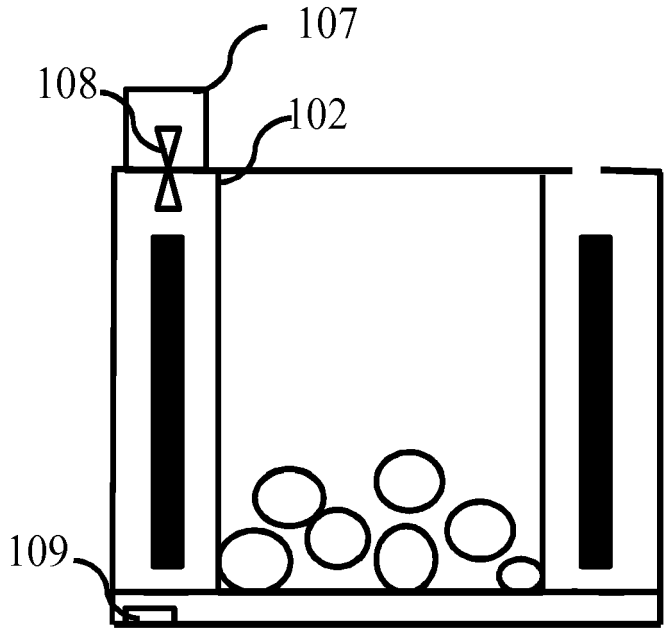

FIG.5

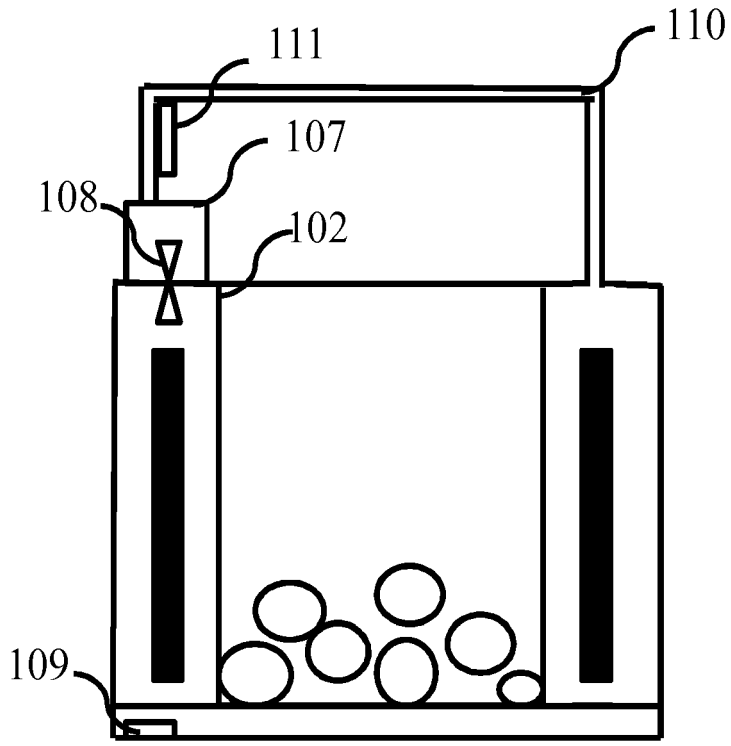

FIG.6

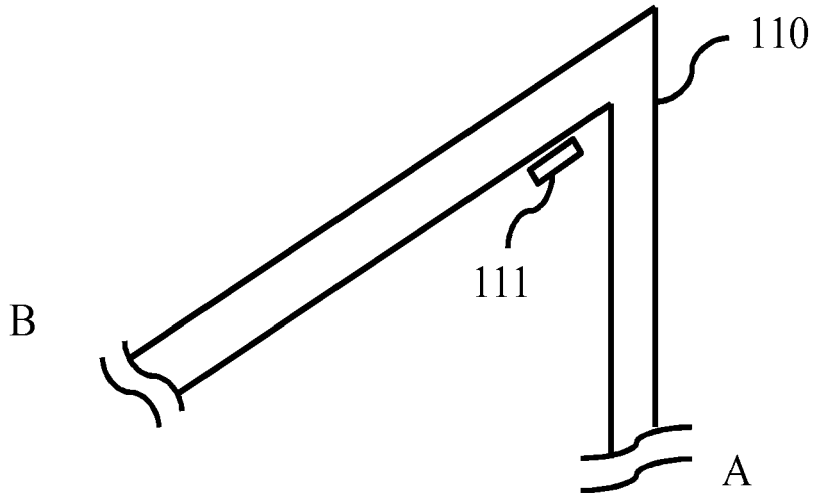

FIG.7

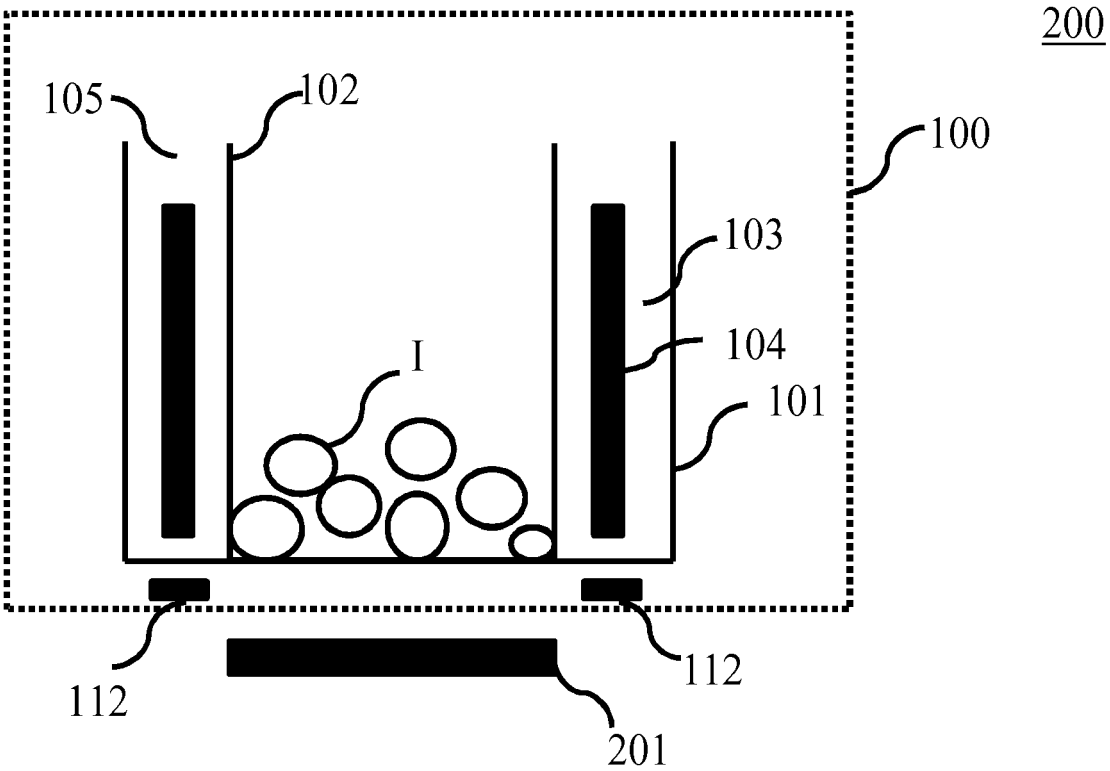

FIG.8

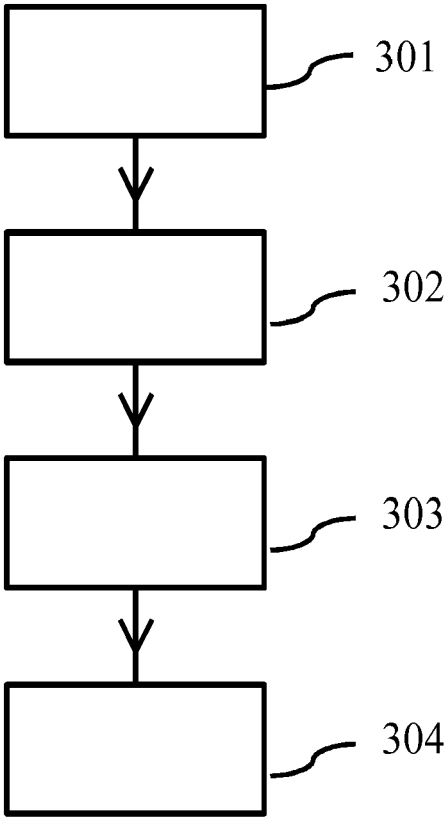

FIG.9

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 6187

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2002/104319 A1 (PAINE LISA JANE [GB] ET AL) 8 August 2002 (2002-08-08) * abstract; figure 7 * * paragraphs [0179] - [0181], [0184], [0185] *	1,2,5-8, 12,13,15 4,9,10	INV. F25D31/00 F25B17/08
X Y A	WO 2008/015608 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; SLOOT ERIC M [NL]; BOERSMA JOLDER) 7 February 2008 (2008-02-07) * abstract; figure 3 * * page 4, paragraph 3 * * page 7, paragraph 3 - page 8, paragraph 2 *	12-14 4,9,10 1,2	
X	WO 99/37958 A1 (UNIV NOTTINGHAM [GB]; RIFFAT SAFFA BASHIR [GB]) 29 July 1999 (1999-07-29) * abstract; figures 1, 2-4 * * page 16, paragraph 3 - page 17, paragraph 1 *	1,5,6, 12,13	
X	DE 103 11 004 A1 (EGO ELEKTRO GERAETEBAU GMBH [DE]) 16 September 2004 (2004-09-16) * abstract; figures 1, 2 * * paragraphs [0023], [0024], [0027], [0028], [0029] *	1,5,7,8, 11-13,15	TECHNICAL FIELDS SEARCHED (IPC) F25B F25D
X	US 5 088 302 A (TOMIZAWA TAKESHI [JP] ET AL) 18 February 1992 (1992-02-18) * abstract; figures 1-3 * * column 3, line 37 - column 5, line 52 *	1-3,12, 13	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 February 2016	Yousufi, Stefanie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2008/012515 A2 (SCOTTISH & NEWCASTLE PLC [GB]; DAVIES JAMES [GB]; BASSIL ROBERT [GB];) 31 January 2008 (2008-01-31) * abstract; figures 5, 6 * * page 7, paragraph 4 * * page 8, paragraph 1 * * page 9, paragraph 1 * * page 13, paragraph 3 * * page 14, paragraph 4 * -----	1,3,12	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 February 2016	Yousufi, Stefanie

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