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(54) ICE DETECTION ARRANGEMENT FOR DETECTING THE QUANTITY OF ICE IN THE ICE COMPARTMENT OF A REFRIGERATOR

(57) This invention addresses an ice detection array for detecting the quantity of ice cubes in an ice compartment (8) of an icebox, refrigerator or freezer. The array comprises an ice cube receipt and storage compartment (8) with at least one projection (9) on its outer surface, and a resilient device (10) fitted to one of the inner walls (11) of the refrigerator. The resilient device (10) operates jointly with projection (9), varying between a tensioned configuration and an at-rest configuration, depending on the quantity of ice remaining in the ice compartment.

The variation of the resilient device (10) between its tensioned configuration and its at-rest configuration trips the low ice indicator circuit that notifies the user that the ice cubes are running low in the compartment.

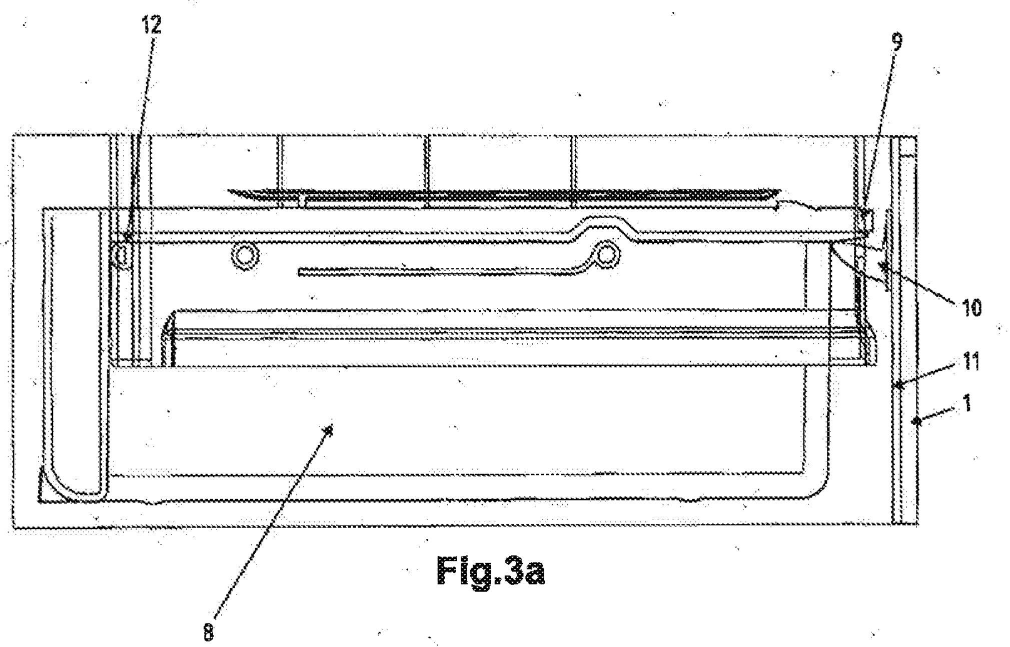

Fig.3a

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Description

Field of the Invention

[0001] This invention refers to an ice detection array, and more specifically to an ice detection array designed to detect the quantity of ice cubes in an ice compartment of an icebox, refrigerator or freezer.

Background of the Invention

[0002] Iceboxes and refrigerators known to the state of the art have compartments that store ice in the form of cubes or similar pieces. These compartments may be associated with automatic ice-makers or ice trays in refrigerators and freezers fitted with automatic ice making systems.

[0003] It is common to provide the means for dispensing the ice directly from the compartment or even through an external ice outlet located on the door of the refrigerator.

[0004] The automatic ice-making system in modem refrigerators basically comprises the following components: a source of water, the ice-maker as such, an ice dispenser and the ice compartment that receives and stores the ice cubes. Thus, in a conventional automatic ice-making system, the water is fed into the ice molds of the ice-maker and, after a specific period of time or until the thermostat indicates a specific temperature, the bottom of the ice mold is heated briefly in order to release the ice cubes. After release, the ice cubes are ejected - generally through the use of ejector sheets built into the ice-maker, dropping into an ice compartment positioned below the ice-maker.

[0005] In this type of system, the ice cube ejection action generally activates the new ice-making circuit, with the supply of more water to the ice-maker.

[0006] The manual ice-making systems known in current refrigerators generally comprise a manual ice-maker defined by a casing, encompassing one or more ice trays linked to ice release buttons and a water tank positioned above the trays, with an ice compartment positioned below the casing. Thus, for the system to operate, the water tank is filled manually by the user and then releases water into the ice trays. After the ice forms, the user presses the ice release button, tipping the contents of the tray into the ice compartment positioned below the casing.

[0007] In these manual ice-making systems known to the state of the art, it is the user that must start the ice making process by filling the water tank.

[0008] The ice-making cycles of both the manual and automatic ice-making systems end with the transfer of the ice cubes or pieces into the ice compartment of the refrigerator freezer.

[0009] However, both the automatic and manual ice-making systems present an inconvenient aspect in their operations: as from the time that the ice cubes or pieces are released from the ice-maker, it becomes impossible to control the quantity of ice in this compartment.

[0010] For the automatic ice-making systems, this is a notable problem: as the fabrication cycles in most of these systems starts again after the release of the ice cubes, the lack of information on the quantity of ice in the compartment may result in the situation where the ice is being produced at a speed faster than it is being consumed. This situation would lead to the "overflowing" of the ice compartment, and consequently possible damage to the equipment.

[0011] However, the disadvantage offered by this characteristic is found even in manual ice-making systems: as the user must start the ice-making process by filling the water tank, if the user does not notice that the ice compartment is empty, he runs the risk of being without ice until the entire fabrication cycle is completed.

Description of the state of the art

[0012] Some solutions have been developed in an attempt to resolve the problem of the lack of information regarding the quantity of ice cubes or pieces in the ice compartment of the refrigerator freezer. However, as will be discussed below, even these solutions present inconvenient aspects.

[0013] The most common solution for detecting the quantity of ice cubes in a reception compartment associated with an automatic ice-making system comprises a lever arm immersed in the compartment. This arm is constantly in contact with the ice cubes, and its movement indicates the level of ice in the compartment. Examples of this type solution are described in the following documents: US 3.885.400 (Sensing arrangement for ice-maker), US 4.007.602 (Exterior ice service for freezer-refrigerators), US 4.872.318 (Shut-off mechanism for ice-maker) and US 2007/0103940 (ice-cube complete filling detector and refrigerator comprising the same).

[0014] The main inconvenient aspect of this solution is the fact that it includes the entire mechanism for operating the arm, with this mechanism normally comprised of several parts that work jointly with the ice-making system and with the ice reception compartment. Thus, by opting for this solution, not only its components and associated mechanisms must be designed, but also its interaction with the ice-making system and with the ice compartment. Furthermore, in this solution the arm is constantly in contact with the ice cubes that will be consumed, giving rise to concern over the hygiene of the set of equipment as a whole.

[0015] Another known type of solution is that described in the JP2003329348 document (Deicing completion detector of an automatic ice-making machine). This document shows a de-icing detector that uses a detection element in contact with the ice cubes in an ice-tray. The detection element is held taut by a spring, so that one end of the element is always in contact with the ice cubes. When the ice cubes are separated and tipped out of the ice tray, the end of the detection element is pushed by elastic force, and the other end of the detection element comes into contact with a detection lever on the detection switch.

[0016] However, this solution presents the same inconvenient aspects as those using the lever arm immersed in the ice compartment.

[0017] Yet another solution is presented in the PI 9610565-8 document (device for monitoring and controlling the level of ice in an ice storage recipient). This document shows a device for monitoring and controlling the level of the ice in an ice storage recipient 62 that includes an emission device fitted into the ice storage recipient and a detector fitted directly across from the emitter. The pulse circuit triggers the emitter that emits a pulse sequence that trips the detector. The receiver circuit emits the signal in response to the pulse sequence detection by the detector, and the control element trips the icemaker that responds to the receiver circuit outlet.

[0018] Although the solution does not make use of the lever arm, it is a highly complex and costly alternative.

[0019] Finally, it must be stressed that the known solutions are designed for automatic ice-making systems. As manual ice-making systems are endowed with precisely the characteristic of low costs, the application of these solutions to this type of manual system would be too costly to justify its inclusion.

Purposes of the Invention

[0020] Pursuant to the matters set forth above, the objectives addressed by this invention include the supply of an ice detection array in an ice compartment that is economic and easy to build.

[0021] Another of the objectives addressed by this invention is to provide an ice detection array in an ice compartment that can be used with automatic and manual ice-making systems.

[0022] Another of the objectives addressed by this invention is to provide an ice detection array in an ice compartment whose operations do not require parts to come into direct contact with the ice cubes.

[0023] And another of the objectives addressed by this invention is to provide an ice detection array that does not interfere too much in the assembly, functioning and operation of the ice-making system.

Summary of the Invention

[0024] This invention attains the objectives listed above through an ice detection array that comprises an ice cube receipt and storage compartment with at least one projection on its outer surface, and a resilient device fitted to the inner surface of the refrigerator.

[0025] The resilient device works with the ice compartment projection, varying between a tensioned configuration and an at-rest configuration pursuant to the quantity of ice left in the ice compartment. This variation in the resilient device from its tensioned configuration to its at-rest configuration trips the low ice indicator circuit, advising the user that the ice cubes are running low in the compartment.

[0026] In a preferred embodiment of this invention, the resilient device is configured to support and uphold the ice compartment, with the array also comprising a means of rotation to allow the ice compartment to complete a rotating movement around a geometric axis running through the compartment.

[0027] The resilient device in the array addressed by this invention may be located on the inner surface of the rear wall or the inner surface of the side walls of the refrigerator.

[0028] In a preferred embodiment of the invention, the projection is a flange that extends substantial around the entire opening edge of the ice compartment, and the resilient device comprises a rocker switch.

Brief Description of the Drawings

[0029] The Figures show:

Figure 1 - Figure 1 illustrates a refrigerator freezer compartment including a conventional manual ice-making system.

Figure 2 - Figure 2 illustrates a diagrammatic view showing the operation of a manual ice-making system used in conventional refrigerators.

Figure 3a - Figure 3a illustrates a diagrammatic view of a first embodiment of the ice detection array addressed by this invention, in a configuration where the ice compartment is empty.

Figure 3b - Figure 3b illustrates in detail the joint operating structure of the ice detection array for the configuration illustrated in Figure 3a.

Figure 4a - Figure 4a illustrates a diagrammatic view of a first embodiment of the ice detection array addressed by this invention, in a configuration where the ice compartment is full.

Figure 4b - Figure 4b illustrates in detail the joint operating structure of the ice detection array for the configuration illustrated in Figure 4a.

Figure 5 - Figure 5 illustrates a diagrammatic view of a second embodiment of the ice detection array addressed by this invention.

Figure 6 - Figure 6 illustrates a cross-section view of the second embodiment of the ice detection array addressed by this invention.

Figure 7 - Figure 7 illustrates a detailed view of the joint operating structure of the ice detection array of the second embodiment of the ice detection array addressed by this invention.

Figure 8a - Figure 8a illustrates a diagrammatic view of the second embodiment of the ice detection array addressed by this invention, in a configuration where the ice compartment is empty.

Figure 8b - Figure 8b illustrates in detail the joint operating structure of the ice detection array for the configuration illustrated in Figure 8a.

Figure 9a - Figure 9a illustrates a diagrammatic view of the second embodiment of the ice detection array addressed by this invention, in a configuration where the ice compartment is full.

Figure 9b - Figure 9b illustrates in detail the joint operating structure of the ice detection array for the configuration illustrated in Figure 9a.

Retailed Description of the Invention

[0030] The invention will be described in greater detail below, based on the executory examples presented in the drawings. Although the following description exemplifies the detection array associated with a specific manual ice-making system, any person familiar with the state of the art will understand that this invention may be used in any refrigerator ice storage compartment, whether associated with a manual fabrication system or an automatic fabrication system, or even on a stand-alone basis in the refrigerator.

[0031] Figure 1 illustrates a refrigerator freezer compartment 1 comprising a conventional manual ice-making system 3.

[0032] As may be seen in detail in Figure 2, this manual ice-making system includes a manual ice-maker 3 comprising a casing 4 that surrounds the water tank 5 and one or more ice trays 6. When assembling the ice-maker, the water tank 5 is positioned above the trays, providing the trays with the amount of water required to fill them. The trays 6 are associated with ice release buttons 7, which turn the trays when pressed, releasing the ice cubes.

[0033] An ice receipt and storage compartment 8 is fitted below the ice trays 6, which receives and stores the ice cubes.

[0034] During the operation of the system illustrated in Figure 2, the water tank 5 is filled manually by the user and then releases water into the ice trays 6. After the ice forms, the user presses the ice release button 7, tipping the contents of the tray 6 into the ice compartment 8.

[0035] Figure 3a shows the ice compartment 8 positioned in a refrigerator freezer compartment 1 (shown in cross section).

[0036] In its preferred embodiment, the ice compartment 8 comprises a compartment of conventional size and shape, with its outer surface presenting at least one projection 9. In the preferred embodiment illustrated in Figure 3, this projection 9 has the shape of a flange on the open edge of this compartment, substantially occupying the entire length of this edge. However, it must be understood that the projection 9 may be located at any point on the outer surface of the compartment 8, with a size that is far smaller than the dimensions of this surface.

[0037] The assembly of the ice compartment 8 in the refrigerator freezer 1 also makes provision for a means of rotating the compartment along the geometric axis running from the compartment 8, set crosswise to the movement of the compartment. In embodiment illustrated in Figure 3a, this rotation axis is indicated by reference number 12, and is located close to the end of the compartment 8, facing the end where this part operates jointly with projection 9.

[0038] The means of rotation addressed by this invention may comprise any means of rotation known to the state of the art, with the preferred embodiment comprising the supply of guiderails designed specially to allow the rotation of the compartment.

[0039] A resilient device 10 is fitted to the inner surface 11 of the freezer compartment of the refrigerator 1. As may be seen in detail in Figure 3b, the resilient device 10 operates jointly with projection 9, supporting and upholding it. As it may be understood by any expert in the state of the art, the resilient device 10 may be fitted to any of the inner surfaces of the refrigerator, with its location depending directly on the location of projection 9 on the ice compartment.

[0040] As will be discussed below, it is the joint operation between projection 9 on the outer surface of the ice compartment 8 and the resilient device 10 on the inner wall of the refrigerator that provides the user with an indication that the ice compartment 8 is empty.

[0041] During the ice dispensing operation shown in Figure 2, when the user presses the release button 7 of the ice-making system, the ice cubes are tipped into compartment 8, with the projection 9 and the resilient device 10 operating jointly in a configuration such as that illustrated in Figures 4a and 4b. In other words, when compartment 8 is full of ice cubes, the weight of the compartment is sufficient to overcome the resistance of device 10, and the compartment 8 tips on its rotating axis 12, pressuring and shifting device 10.

[0042] As the ice cubes are removed from the compartment 8, the weight of the compartment is reduced, and the elastic force of the resilient device 10 becomes sufficient to force the compartment 8 to rotate in the other direction back to the position shown in Figures 3a and 3b. Naturally, this position may correspond to a pre-established quantity of ice cubes through merely designing the resilient device appropriately for this purpose.

[0043] Thus, in the illustrations presented in Figures 3a and 3b, the ice compartment 8 is not full of ice and the force imposed by the ice compartment 8 on the resilient device 10 is not sufficient to shift it substantially. In other words, the elastic force of the device 10 is sufficient to withstand the weight of the compartment 8.

[0044] On the other hand, in the illustrations presented in Figures 4a and 4b, the ice compartment 8 holds a larger quantity of ice and the force imposed on the resilient device 10 is sufficient to overcome its resistance, shifting it.

[0045] In other words, the resilient device 10 shifts between its tensioned configuration (see Figures 4a and 4b) and its at-rest configuration (see Figures 3a and 3b) depending on the quantity of ice cubes that still remain in the ice compartment 8.

[0046] In a preferred embodiment addressed by this invention, the variation in the status of resilient device 10, from its tensioned configuration to its at-rest configuration trips the indicator circuit advising the user that the ice is running low in the compartment, or has run out, as mentioned above, the quantity of ice necessary to bring the resilient device 10 back to its at-rest condition depends on its characteristics.

[0047] This indication may be given through any appropriate interface, such as lighting up a LED on the refrigerator, for example.

[0048] Figures 5 to 9b shown an alternative embodiment of the ice detection array addressed by this invention, where the resilient device 10 is located on the inner side surface of the refrigerator.

[0049] As may be seen in Figures 5 to 7 in this embodiment, the ice compartment 8 presents a projection 9 in the form of a flange in the open side of the compartment, substantival occupying the entire length of this edge, except for its front part.

[0050] Similar to the illustrations presented in Figures 3a to 4b, Figures 8a to 9b show the operating principle of the detection array addressed by this invention.

[0051] During the ice tipping operation shown in Figure 2, when the user presses the release button 7 of the ice-making system, the ice cubes are tipped into the compartment 8, and projection 9 and the resilient device 10 work jointly in a configuration such as that illustrated in Figures 9a and 9b. In other words, when the compartment 8 is full of ice cubes, the weight of the compartment is sufficient to overcome the resistance of device 10 and the compartment 8 turns on its rotating axis 12, imposing tension and shifting device 10.

[0052] As the ice cubes are removed from the compartment 8, the weight of the compartment is reduced and the elastic force of the resilient device 10 becomes sufficient to force compartment 8 to rotate back to the position shown in Figures 8a and 8b. This position naturally corresponds to a pre-established quantity of ice cubes, with an adequate design of the resilient device being sufficient to ensure this.

[0053] Thus, in the illustrations presented in Figures 8a and 8b, the ice compartment 8 is not full of ice and the force imposed by the ice compartment 8 on the resilient device 10 is not sufficient to shift it substantially. In other words, the elastic force of the device 10 is sufficient to withstand the weight of compartment 8.

[0054] On the other hand, in the illustrations presented in Figures 9a and 9b, the ice compartment 8 holds the larger quantity of ice and the force imposed on the resilient device 10 is sufficient to overcome its resistance and move it.

[0055] In other words, the resilient device 10 shifts between its tensioned configuration (see Figures 9a and 9b) and its at-rest configuration (see Figures 8a and 8b) depending on quantity of ice cubes that still remain in the ice compartment 8.

[0056] It must be understood that the description provided on the basis of the Figures mentioned above refers only to two of the possible embodiments of the array addressed by this invention, with the real scope of the purpose of the invention being defined in the appended Claims.

[0057] Along these lines, any person familiar with the state of the art would understand that projection 9 may have any shape and be placed in any position on the outer surface of the ice compartment, with all that is necessary is that its sizes and location be appropriate for working jointly with the resilient device 10 located on the inner surface of the refrigerator. Similarly, the location, shape and dimension of the resilient device must allow its joint operation with projection 9, varying from a tensioned condition when the ice compartment is full of ice to an at-rest condition when a pre-determined quantity of ice is left.

Claims

1. Ice detection array in order to detect the quantity of ice in an ice compartment (8) of a refrigerator (1), **CHARACTERIZED by** the fact that it comprises:

   an ice cube receipt and storage compartment (8), the outer surface of the compartment (8) comprising at least one projection (9), and
   a resilient device (10) fitted to the surface of one of the inner walls (11) of the refrigerator, where the resilient device (10) operates jointly with the projection (9), varying between a tensioned configuration and an at-rest configuration, depending on the quantity of ice remaining in the compartment (8).

2. A detection array, as set forth in Claim 1, **CHARACTERIZED by** the fact that the variation of the resilient device (10) from its tensioned configuration to its at-rest configuration trips the low ice indicator circuit.

3. An ice detection array, as set forth in Claim 1 or 2, **CHARACTERIZED by** the fact that the resilient device (10) is configured to support the projection (9) and uphold the ice compartment (8), where the array/arrangement also comprises a means of rotation allowing the ice compartment (8) to rotate on a geometric axis (12) running through the ice compartment (8).

4. An ice detection array, as set forth in any of Claims 1 to 3, **CHARACTERIZED by** the fact that the resilient device (10) is fitted to the inner surface of the rear wall of the refrigerator.

5. An ice detection array, as set forth in any of Claims 1 to 3, **CHARACTERIZED by** the fact that the resilient device (10) is fitted to the inner surface of one

of the side walls of the refrigerator.

6. An ice detection array, as set forth in any of Claims 1 to 5, **CHARACTERIZED by** the fact that the projection (9) is a flange that extends substantially along the entire opening edge of the ice compartment (8).

7. An ice detection array as set forth in any of Claims 1 to 6, **CHARACTERIZED by** the fact that the resilient device (10) comprises a rocker switch.

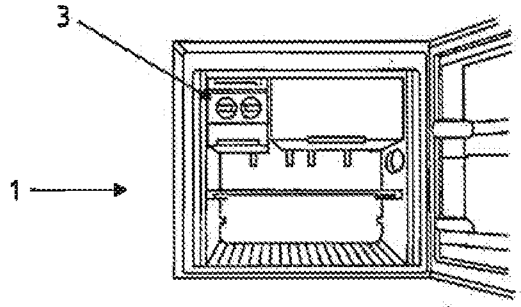

Fig.1

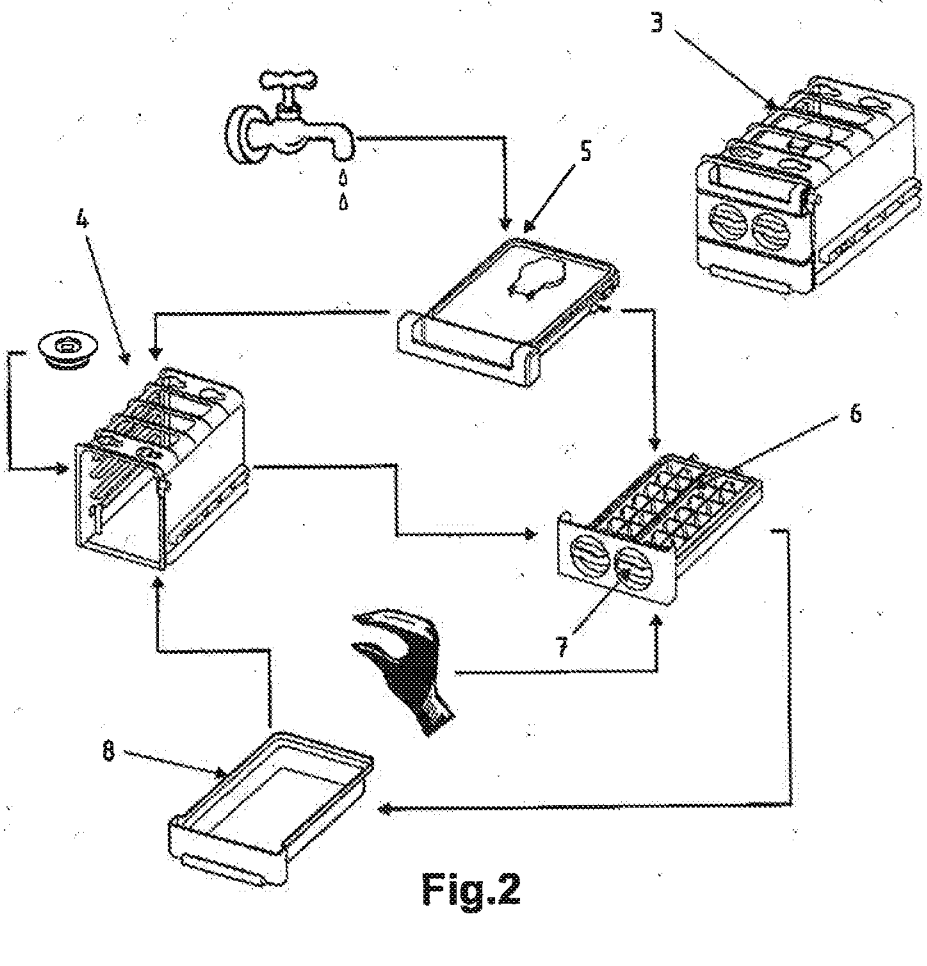

Fig.2

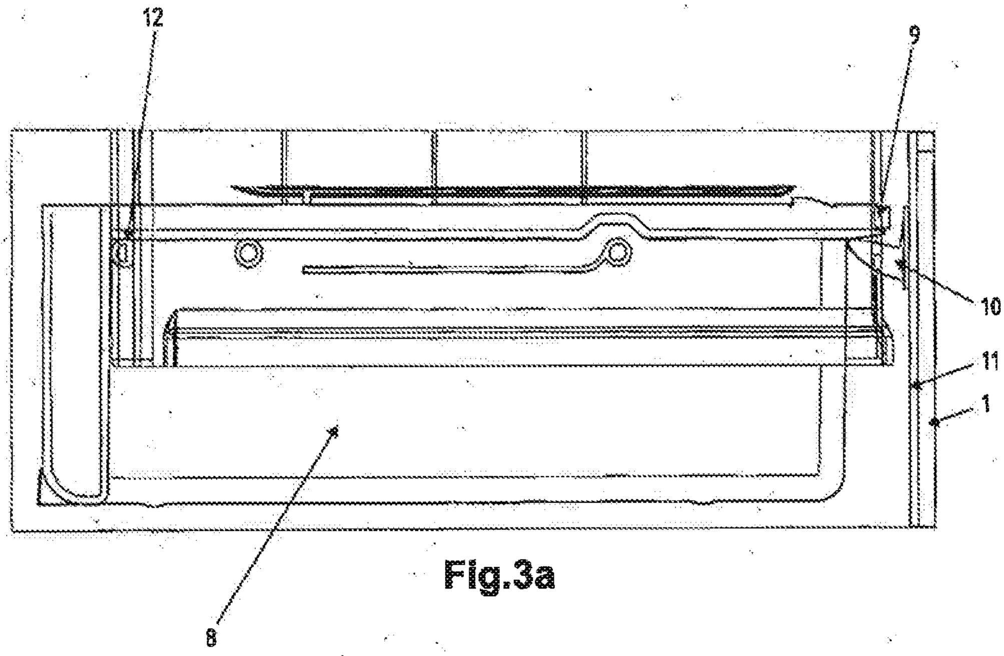

Fig.3a

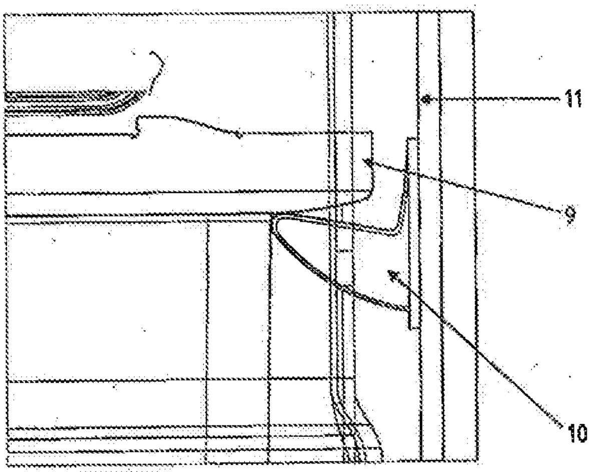

Fig.3b

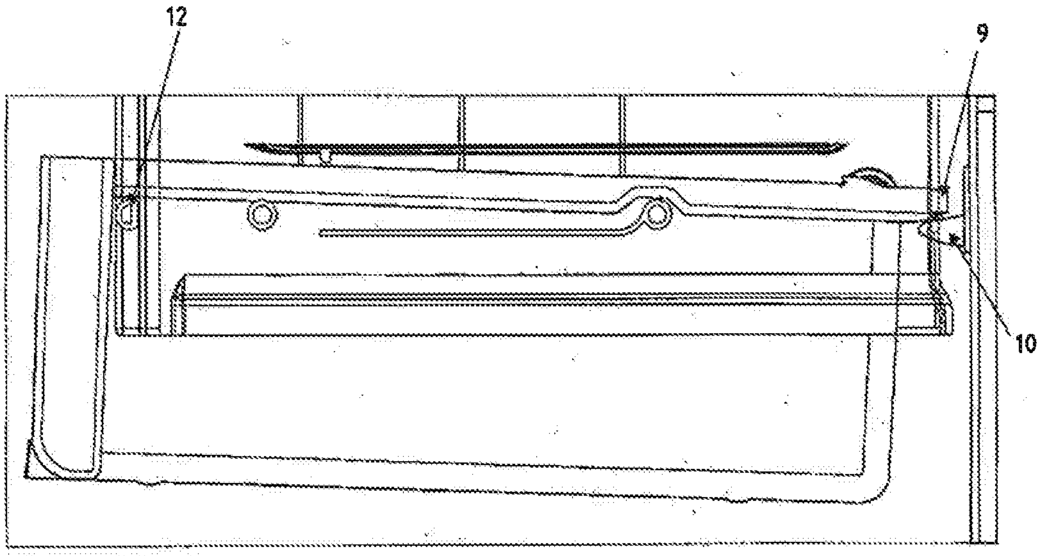

Fig.4a

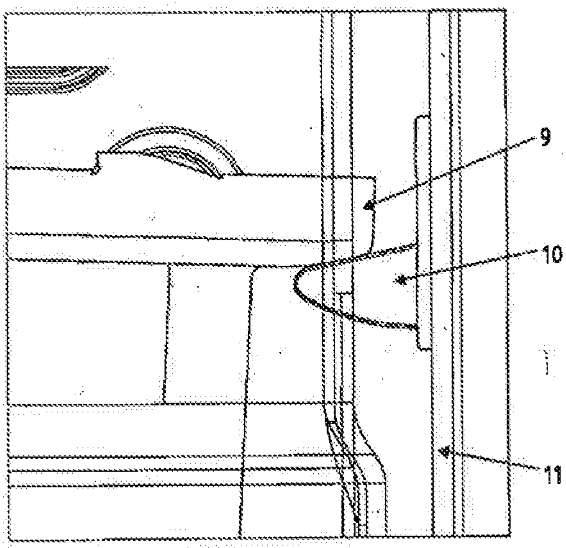

Fig.4b

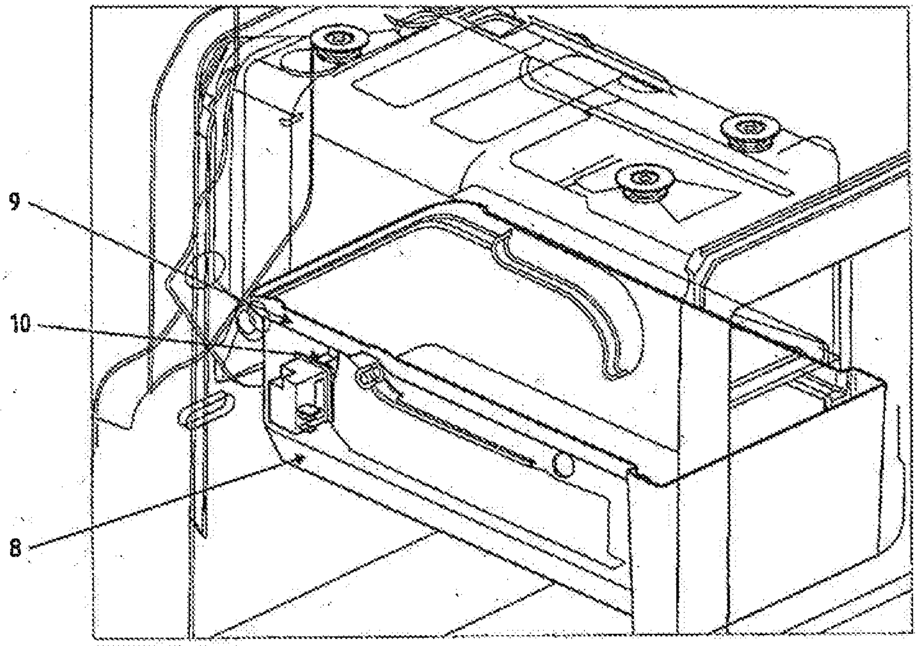

Fig.5

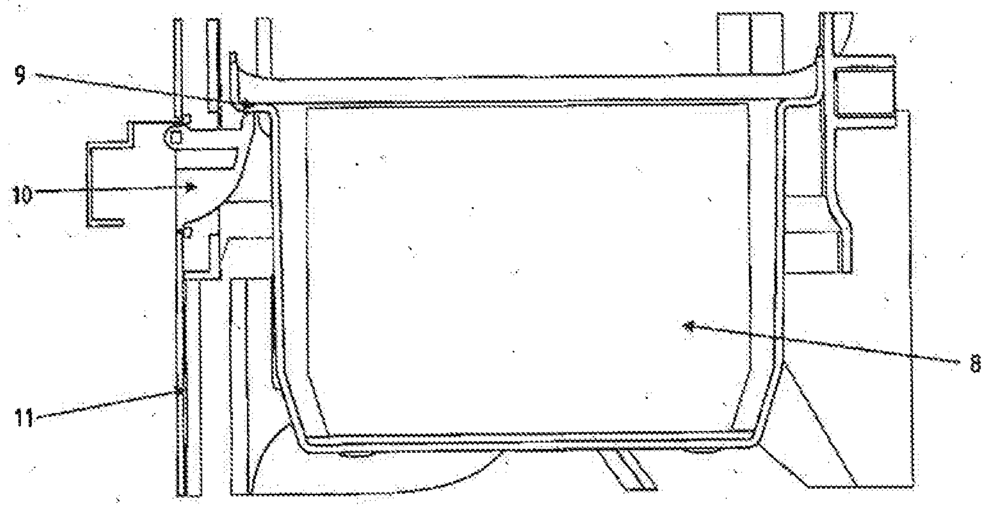

Fig.6

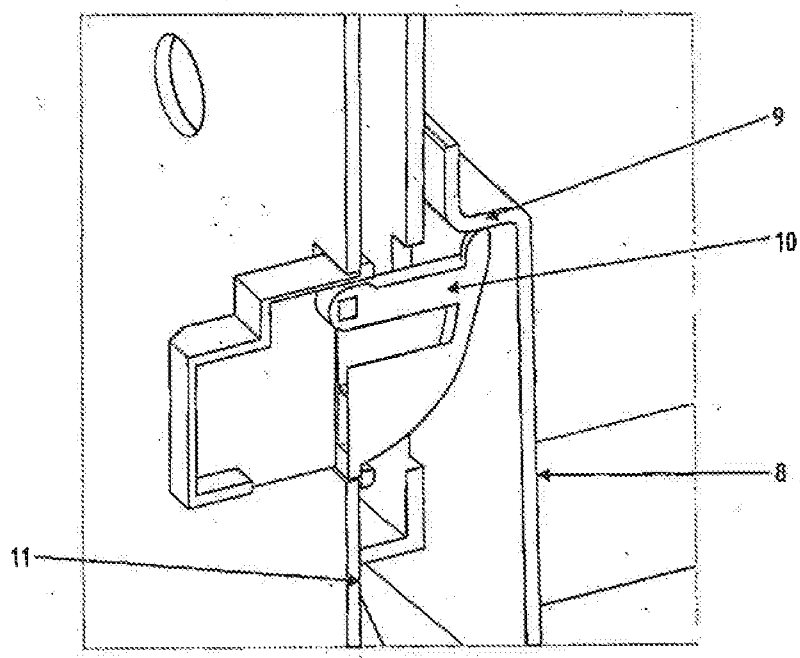

Fig.7

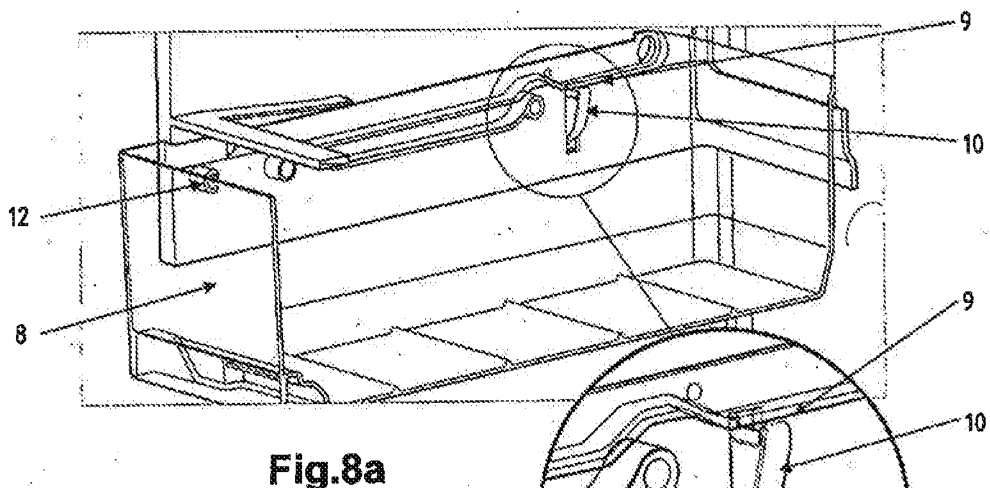

Fig.8a

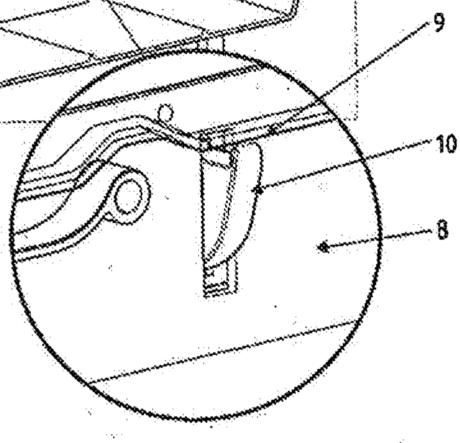

Fig.8b

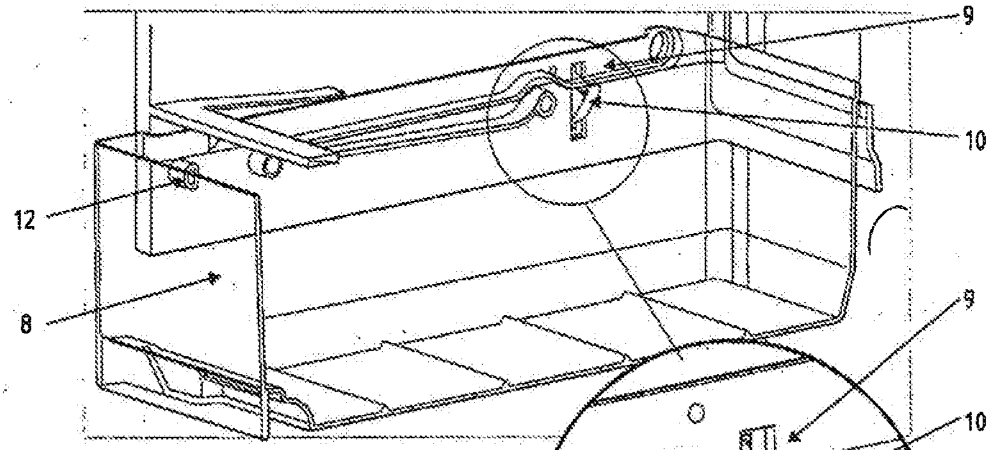

Fig.9a

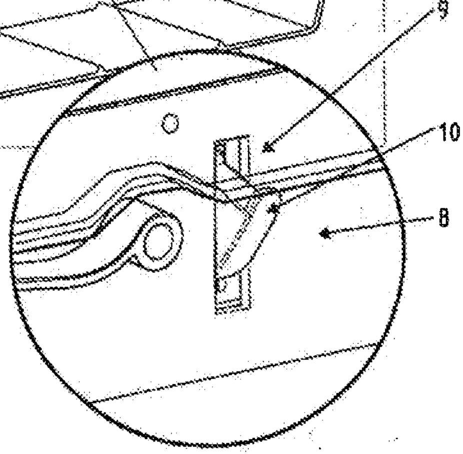

Fig.9b

REFERENCES CITED IN THE DESCRIPTION

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