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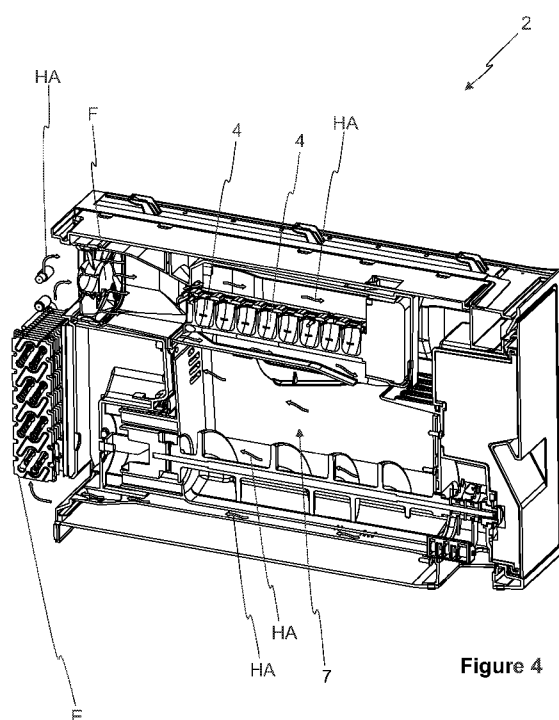


Figure 4

(57) Abstract: The present invention relates to a cooling device (1) comprising an ice making unit (2) having a body (3), a plurality of ice cells (4) on the body (3) to turn the water therein into ice pieces (B), a cell temperature sensor which measures the temperature of the ice cells (4), at least one ice heater which (5) is provided under the ice cells (4) and an ice scraper (6) which transfers the ice pieces (B) in the ice cells (4) to an ice storage unit (7); and the ice storage unit (7).

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A COOLING DEVICE COMPRISING A ICE MAKING UNIT

The present invention relates to a cooling device comprising an ice making unit with improved ice-making speed.

5 Cooling devices, such as refrigerators, are frequently used to meet the need to keep food and beverages cold as well as to make ice. The cooling devices comprises an ice making unit to provide ready-made ice pieces to users effortlessly. In the ice making units, an ice cell is filled with water, which then turns into ice piece. After the water is converted into ice piece, the ice piece is transferred to an ice storage unit. The user can use the ready-made
10 ice pieces in the ice storage unit whenever needed.

When the water turns into ice, the ice pieces stick to the ice cells. To separate the stuck ice piece from the ice cell without any damage, the ice cell is heated by means of a heater. The heated ice cell melts the sticking surface of the ice piece, thus enabling the ice piece to be separated from the ice cell. Then, an ice scraper enables the ice pieces in the ice cells to be
15 transferred to the ice storage unit and stored. As the amount of ready-made ice pieces in the ice storage unit decreases as a result of use, this cycle in the ice making units is repeated to enable the cooling device to always serve ready-made ice pieces to the users.

In the ice making units of the prior art, the ice cell is heated up to a predetermined temperature. This predetermined temperature is determined by reference to the information
20 that ice begins to melt just above 0 °C. Therefore, the predetermined temperature is a temperature above 0 °C. Accordingly, the heater is expected to heat the ice cell until the ice cell reaches a temperature above 0 °C. After the ice cell reaches a temperature above 0 °C, the ice piece in the ice cell is transferred to the ice storage unit by means of an ice scraper.

The time required for the ice cell to heat up to a temperature above 0 °C significantly
25 increases the ice making time of the ice making unit. In other words, said waiting time significantly reduces the ice-making speed. However, heating the ice cell to a temperature above 0 °C causes the formation of a large water film on the ice piece surface. The large water film causes the ice pieces to stick to each other in the ice storage unit and/or to the ice storage unit. This sticking causes the ice pieces to merge and become unusable. Moreover,

this may cause the user to injure himself/herself while trying to separate the ice pieces from each other. Furthermore, there is a risk that the plastic components in the ice dispensing units may break and reach the ice pieces and from the ice pieces to the user's beverages. If this situation is not noticed by the user, it can cause serious injuries.

- 5 In the state of the art American Patent Document No. US2017089629A1, when an ice maker operates the ice separation heater, the refrigerator is enabled to recognize the operating status of the ice separation heater. When the ice maker notifies that the ice separation heater is in operation, the refrigerator may reduce or stop power being supplied to the electronic components. The ice maker comprises a tray which receives liquid, an
10 ejector which discharges ice pieces frozen in the tray, a first heater which provides heat to the tray, and an ice maker control unit. When the heater is operated, the ice maker enables the main control unit of the refrigerator to detect when the ice making process is completed or the heater has started operating.

The aim of the present invention is the realization of a cooling device having an ice making
15 unit with improved ice-making speed by improving the processes of heating the ice cell, separating the ice piece from the ice cell and transferring the ice piece to the ice storage unit.

The cooling device of the present invention comprises an ice making unit having a body, a plurality of ice cells on the body to turn the water therein into ice pieces, a cell temperature
20 sensor which measures the temperature of the ice cells, at least one ice heater which is provided under the ice cells and an ice scraper which transfers the ice pieces in the ice cells to an ice storage unit; and the ice storage unit. The cooling device further comprises a processing unit which is configured to start to heat the ice cells by means of the ice heater to ensure the separation of the ice pieces from the ice cells; when the cell temperature
25 sensor detects that the ice cells have reached a first temperature, to start to transfer the ice pieces in the ice cells to the ice storage unit by means of the ice scraper; and to stop heating the ice cells when the cell temperature sensor detects that the ice cells have reached a second temperature before the ice pieces in the ice cells are transferred to the ice storage unit by means of the ice scraper. In the embodiments of the present invention, when the ice
30 cells reach the first temperature, the ice scraper starts to transfer the ice pieces in the ice

cells to the ice storage unit. In other words, when the cell temperature sensor detects that the ice cells have reached the first temperature, the ice scraper starts to remove/scrape/slide the ice pieces in the ice cells from the ice cells. The melting temperature of ice varies depending on the density of the water, natural minerals such as calcium and magnesium, and/or additional ingredients such as chlorine. However, the melting temperature of water is inversely proportional to the pressure, and as the pressure increases, the melting temperature decreases. The first temperature may be selected by taking into account the water content and/or the pressure applied to the ice pieces by the ice scraper. The first temperature is an equilibrium temperature at a phase change temperature at the water freezing/ice melting temperature. The conditions taken into account when determining said first temperature ensure that the first temperature is lower than the predetermined temperatures. The ice cells are brought to the first temperature by means of the ice heater in less time than the prior art. Thus, the process of transferring the ice pieces in the ice cells to the ice storage unit by means of the ice scraper starts at lower temperatures. Thus, the time required for the ice cells to be brought to the first temperature by means of the ice heater is shortened and the ice-making speed of the ice making unit is improved. Moreover, the transfer of the ice pieces in the ice cells to the ice storage unit by means of the ice scraper can be performed by transferring less heat to the ice cells. Thus, a smaller water film is formed on the ice pieces transferred to the ice storage unit. This enables the ice pieces stuck together to be separated more easily and/or the stuck ice pieces to be removed from the ice storage unit without damaging the ice storage unit.

In an embodiment of the present invention, the cooling device comprises a processing unit which is configured to stop heating the ice cells when the cell temperature sensor detects that the ice cells have not yet reached the second temperature when the transfer of the ice pieces in the ice cells to the ice storage unit by means of the ice scraper is completed. Thus, in case there is no ice piece in the ice cells, the heating of the ice cells and the related energy consumption are prevented.

In an embodiment of the present invention, the first temperature is a temperature between -5 °C and 0 °C.

In a variation of this embodiment of the present invention, the first temperature is -3 °C.

In an embodiment of the present invention, the second temperature is a temperature greater than 0 °C and less than 10 °C. The formation of high amounts of water film is observed if the second temperature is higher than 10 °C. The formation of high amounts of water film may cause the problem of ice pieces sticking in the ice storage unit.

- 5 In a variation of this embodiment of the present invention, the second temperature is 5 °C.

In an embodiment of the present invention, there is a temperature difference of 2 °C-15 °C between the first temperature and the second temperature.

- 10 In an embodiment of the present invention, the ice scraper has a scraping shaft, scraping claws which are provided on the scraping shaft, which can rotate in the ice cells and which separate the ice pieces from a surface of the ice cells; and an actuator which provides rotational movement to the scraping shaft. In this embodiment, the cooling device comprises the processing unit which is configured to start rotating the scraping shaft by means of the actuator to start the transfer of the ice pieces to the ice storage unit by means of the ice scraper. Thus, when the cell temperature sensor detects that the ice cells have
15 reached the first temperature, the ice scraper safely and quickly removes the ice pieces from the ice cells and transfers the ice pieces in the ice cells to the ice storage unit.

In this embodiment of the present invention, the body is manufactured from metal. By means of the high heat conduction of metal, heat transfer between the ice cells and the water therein occurs at a high level.

- 20 In an embodiment of the present invention, the ice storage unit comprises an ice dispensing unit to discharge the ice pieces from the ice storage unit. Thus, the user is enabled to easily access the ice pieces in the ice storage unit. The ice dispensing unit may be in the form of a screw conveyor.

- 25 The cooling device realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 – is the perspective view of the cooling device of the present invention.

Figure 2 – is the perspective view of an exemplary ice making unit in the cooling device of the present invention.

Figure 3 – is the sideways cross-sectional view of an exemplary ice making unit in the cooling device of the present invention.

Figure 4 – is the isometric cross-sectional view of an exemplary ice making unit in the cooling device of the present invention.

- 5 Figure 5 – is the front cross-sectional view of an exemplary ice making unit, which shows the moment when the transfer of the ice pieces in the ice cells to the ice storage unit by means of the ice scraper, especially scraping claws starts.

- Figure 6 – is the front cross-sectional view of an exemplary ice making unit, which shows a moment when the ice pieces are lifted from the inner surfaces of the ice cells a period of
10 time after the transfer of the ice pieces in the ice cells to the ice storage unit by means of the ice scraper, especially scraping claws starts.

- Figure 7 – is the front cross-sectional view of an exemplary ice making unit, which shows another moment when the ice pieces are lifted from the inner surfaces of the ice cells a period of time after the transfer of the ice pieces in the ice cells to the ice storage unit by
15 means of the ice scraper, especially scraping claws starts.

Figure 8 – is the front cross-sectional view of an exemplary ice making unit, which shows a moment when the transfer of the ice pieces in the ice cells to the ice storage unit by means of the ice scraper is completed.

- Figure 9 – is the isometric view of the ice making unit in the cooling device of the present
20 invention.

Figure 10 – is the isometric view of the ice making unit from below shown in Figure 5.

Figure 11 – is the sideways cross-sectional view of an exemplary ice making unit.

Figure 12 – is the isometric cross-sectional view of an exemplary ice making unit.

Figure 13 – is the isometric cross-sectional view of an exemplary ice scraper.

- 25 The elements illustrated in the figures are numbered as follows:

1. Cooling device

2. Ice making unit

3. Body

4. Ice cell

5. Ice heater

6. Ice scraper

5 6.1. Scraping shaft

 6.2 Scraping claw

 6.3 Actuator

7. Ice storage unit

 7.1 Ice dispensing unit

10 F. Cooling fan

 E. Evaporator

 B. Ice piece

 HA. Air flow

15 The cooling device (1) of the present invention comprises an ice making unit (2) having a body (3), a plurality of ice cells (4) on the body (3) to turn the water therein into ice pieces (B), a cell temperature sensor which measures the temperature of the ice cells (4), at least one ice heater which (5) is provided under the ice cells (4) and an ice scraper (6) which transfers the ice pieces (B) in the ice cells (4) to an ice storage unit (7); and the ice storage unit (7).

20 The cooling device (1) further comprises a processing unit which is configured to start to heat the ice cells (4) by means of the ice heater (8) to ensure the separation of the ice pieces (B) from the ice cells (4); when the cell temperature sensor detects that the ice cells (4) have reached a first temperature, to start to transfer the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6); and to stop heating the ice cells (4)

25 when the cell temperature sensor detects that the ice cells (4) have reached a second temperature before the ice pieces (B) in the ice cells (4) are transferred to the ice storage unit (7) by means of the ice scraper (6).

The cooling device (1) of the present invention is operated as follows: After the water in the ice cells (4) is converted into ice pieces (B), in other words, when the ice making unit (2) makes ice pieces (B), the ice pieces (B) are in the ice cells (4) and stick to the inner surface of the ice cells (4). To make new ice pieces (B) and to store the ready-made ice pieces (B) by taking them to the ice storage unit (7), the ice pieces (B) in the ice cells (4) must be removed from the ice cells (4). Therefore, when it is desired to transfer the ice pieces (B) in the ice cells (4) to the ice storage unit (7), the processing unit starts to heat the ice cells (4) by means of the ice heater (8). The cell temperature sensor measures the temperature of the ice cells (4). When the cell temperature sensor detects that the ice cells (4) have reached the first temperature, the processing unit starts the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6). Starting the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) means starting to remove/scrape/slide the ice pieces (B) in the ice cells (4) from the inner surface of the ice cells (4) by means of the ice scraper (6). At the same time, the processing unit continues to heat the ice cells (4) up to the second temperature by means of the ice heater (8). The processing unit stops heating the ice cells (4) when the cell temperature sensor detects that the ice cells (4) have reached the second temperature before the ice pieces (B) in the ice cells (4) are transferred to the ice storage unit (7) by means of the ice scraper (6). The processing unit stops heating the ice cells (4) when the cell temperature sensor detects that the ice cells (4) have not yet reached the second temperature when the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) is completed. The completion of the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) is detected by means of a presence sensor. The first temperature can be a temperature below 0 °C.

In an embodiment of the present invention, the cooling device (1) comprises a processing unit which is configured to stop heating the ice cells (4) when the cell temperature sensor detects that the ice cells (4) have not yet reached the second temperature when the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) is completed.

In an embodiment of the present invention, the first temperature is a temperature between -5 °C and 0 °C.

In a variation of this embodiment of the present invention, the first temperature is -3 °C.

- 5 In an embodiment of the present invention, the second temperature is a temperature greater than 0 °C and less than 10 °C.

In a variation of this embodiment of the present invention, the second temperature is 5 °C.

In an embodiment of the present invention, there is a temperature difference of 2 °C-15 °C between the first temperature and the second temperature.

- 10 In an embodiment of the present invention, the ice scraper (6) has a scraping shaft (6.1), scraping claws (6.2) which are provided on the scraping shaft (6.1), which can rotate in the ice cells (4) and which separate the ice pieces (B) from a surface of the ice cells (4); and an actuator (6.3) which provides rotational movement to the scraping shaft (6.1). In this embodiment, the cooling device (1) comprises the processing unit which is configured to
- 15 start rotating the scraping shaft (6.1) by means of the actuator (6.3) to start the transfer of the ice pieces (B) to the ice storage unit (7) by means of the ice scraper (6). In this embodiment of the present invention, when the cell temperature sensor detects that the ice cells (4) have reached the first temperature, the processing unit starts the process of removing the ice pieces (B) in the ice cells (4) by means of the ice scraper (6). For this
- 20 lifting process, the processing unit starts to rotate the scraping shaft (6.1) by means of the actuator (6.3) (Figure 5, Figure 6 and Figure 7) As the scraping shaft (6.1) rotates, the scraping claws (6.2) start to rotate and move towards the ice pieces (B) in the ice cells (4) (Figure 6 and Figure 7). By means of the rotation of the scraping shaft (6.1), the ice pieces (B) are transferred into the ice storage unit (7) (Figure 8). Thus, the transfer of the ice
- 25 pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) is completed. In this embodiment, the completion of the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) can be detected by the processing unit rotating the scraping shaft (6.1) at a selected angle by means of the actuator

(6.3). In an exemplary embodiment of the present invention, the selected angle is an angle between 180° - 360° .

In an embodiment of the present invention, the ice cell (4) is semicircular. The rotation of the scraping shaft (6.1) at the selected angle value enables the ends of the scraping claws
5 (6.2) to make a radial movement at the selected angle value. During this radial movement of the scraping claws (6.2), the semicircular ice pieces (B) are pushed from one corner and subjected to pressure. Thus, the semicircular ice pieces (B) are enabled to be separated from the inner surface of the semicircular ice cells (4).

In an embodiment of the present invention, the body (3) is manufactured from metal. In this
10 embodiment, the body (3) is preferably manufactured from aluminum or copper due to its high thermal conductivity. Thus, the heat transfer to the water in the ice cells (4) is carried out with high efficiency and the ice making speed of the cooling device (1) is increased.

In an embodiment of the present invention, the ice storage unit (7) comprises an ice dispensing unit (7.1) to discharge the ice cubes (B) from the ice storage unit (7). Thus, the
15 user is enabled to easily access the ice cubes (B) in the ice storage unit (7). In a variation of this embodiment, the ice dispensing unit (7.1) is in the form of a screw conveyor.

In an embodiment of the present invention, the cooling device (1) may comprise a water supply unit which fills the ice cells (4) with water after the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) is completed; an
20 evaporator (E) and a cooling fan (F) which is used to circulate the air in the ice making unit (2) and to convert the water in the ice cells (4) into ice pieces (B) (to freeze the water). The cooling fan (F) provides the air flow (HA) between the evaporator (E) surface and the inner surface of the ice making unit (2).

CLAIMS

1. A cooling device (1) **comprising** an ice making unit (2) having a body (3), a plurality of ice cells (4) on the body (3) to turn the water therein into ice pieces (B), a cell temperature sensor which measures the temperature of the ice cells (4), at least one ice heater which (5) is provided under the ice cells (4) and an ice scraper (6) which transfers the ice pieces (B) in the ice cells (4) to an ice storage unit (7); and the ice storage unit (7), **characterized by** a processing unit which is configured
- to start to heat the ice cells (4) by means of the ice heater (8) to ensure the separation of the ice pieces (B) from the ice cells (4);
 - when the cell temperature sensor detects that the ice cells (4) have reached a first temperature, to start to transfer the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6); and
 - to stop heating the ice cells (4) when the cell temperature sensor detects that the ice cells (4) have reached a second temperature before the ice pieces (B) in the ice cells (4) are transferred to the ice storage unit (7) by means of the ice scraper (6).
2. A cooling device (1) as in Claim 1, **characterized by** a processing unit which is configured to stop heating the ice cells (4) when the cell temperature sensor detects that the ice cells (4) have not yet reached the second temperature when the transfer of the ice pieces (B) in the ice cells (4) to the ice storage unit (7) by means of the ice scraper (6) is completed.
3. A cooling device (1) as in Claim 1 or Claim 2, **characterized in that** the first temperature is a temperature between -5 °C and 0 °C.
4. A cooling device (1) as in any one of the above claims, **characterized in that** the first temperature is -3 °C
5. A cooling device (1) as in any one of the above claims, **characterized in that** the second temperature is a temperature greater than 0 °C and less than 10 °C.

6. A cooling device (1) as in any one of the above claims, **characterized in that** the second temperature is 5 °C
7. A cooling device (1) as in Claim 1 or Claim 2, **characterized in that** there is a temperature difference of 2 °C-15 °C between the first temperature and the second temperature.
8. A cooling device (1) as in any one of the above claims, **characterized by** the ice scraper (6) having a scraping shaft (6.1), scraping claws (6.2) which are provided on the scraping shaft (6.1), which can rotate in the ice cells (4) and which separate the ice pieces (B) from a surface of the ice cells (4); and an actuator (6.3) which provides rotational movement to the scraping shaft (6.1), and the processing unit which is configured to start rotating the scraping shaft (6.1) by means of the actuator (6.3) to start the transfer of the ice pieces (B) to the ice storage unit (7) by means of the ice scraper (6).
9. A cooling device (1) as in any one of the above claims, **characterized by** the body (3) which is metal.
10. A cooling device (1) as in any one of the above claims, **characterized by** the ice storage unit (7) comprising an ice dispensing unit (7.1) to discharge the ice cubes (B) from the ice storage unit (7).

Figure 1

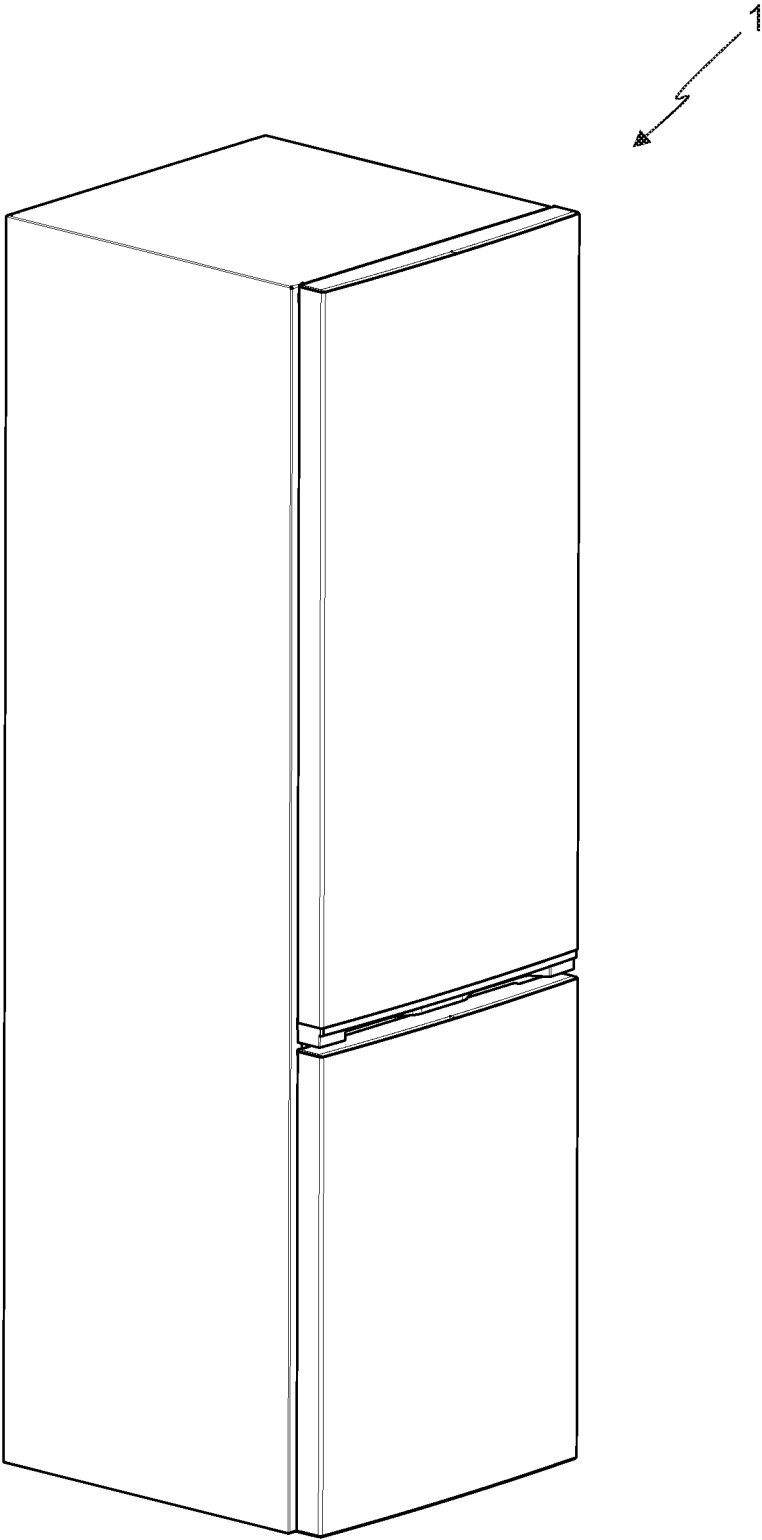


Figure 2

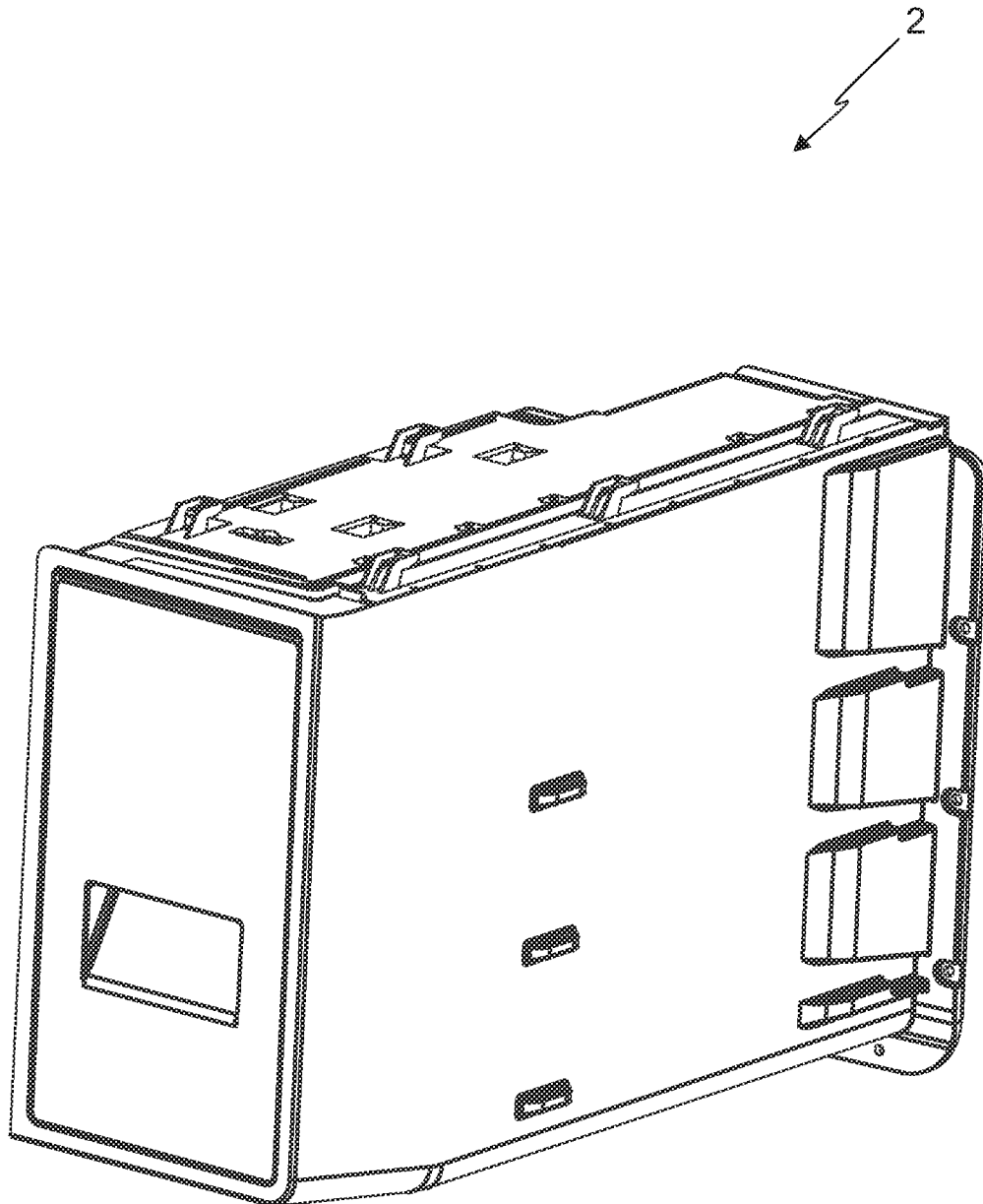


Figure 3

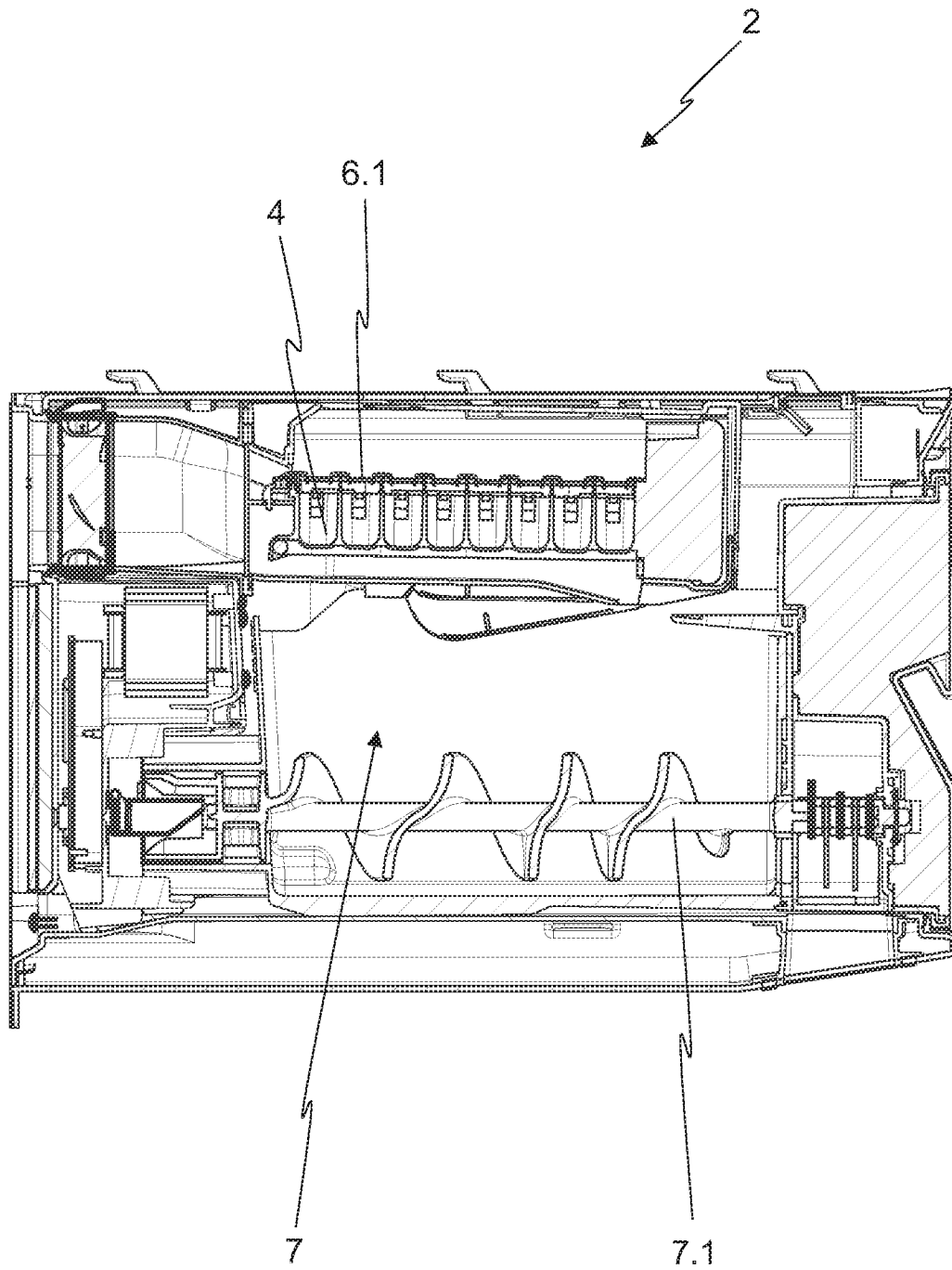


Figure 4

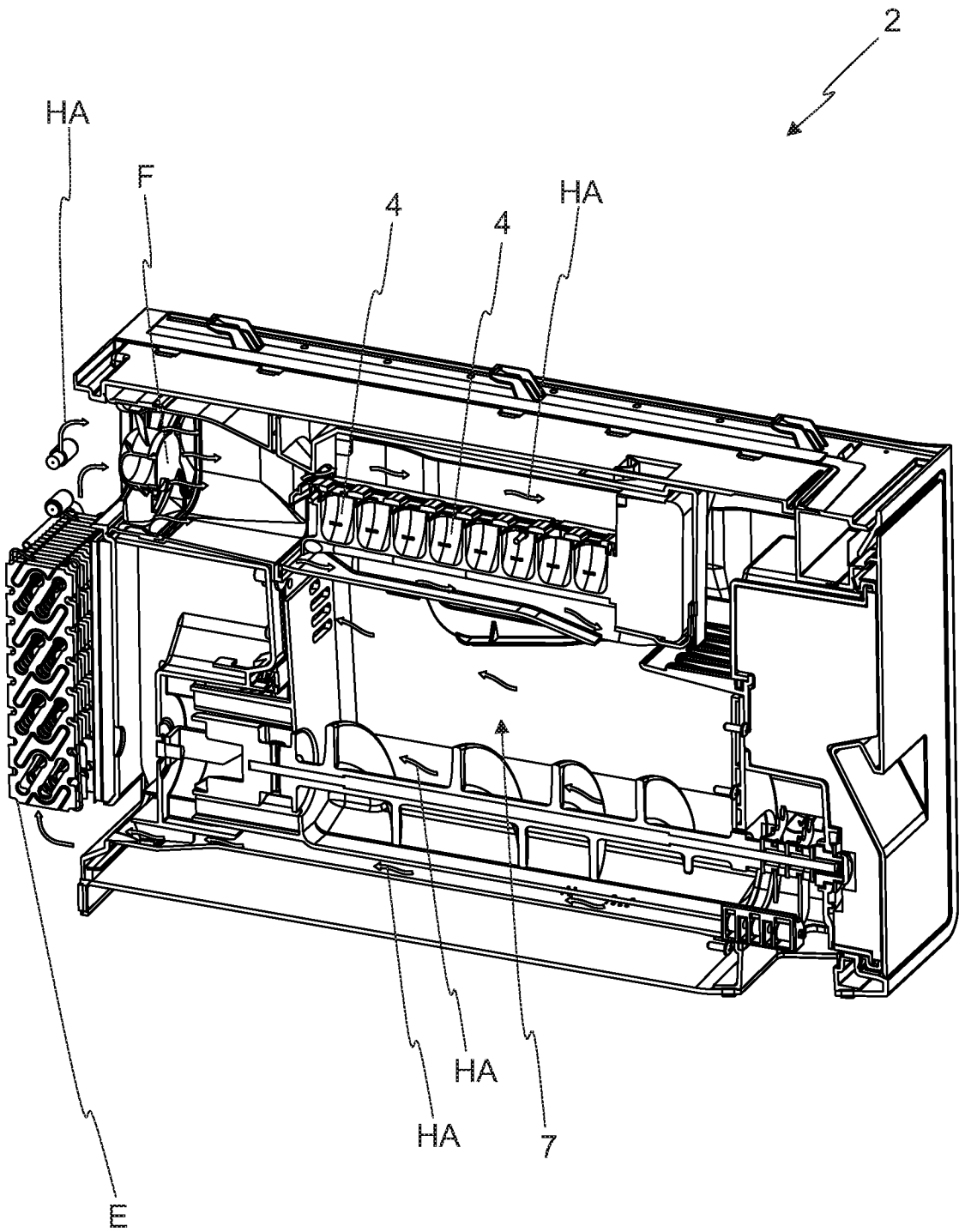


Figure 5

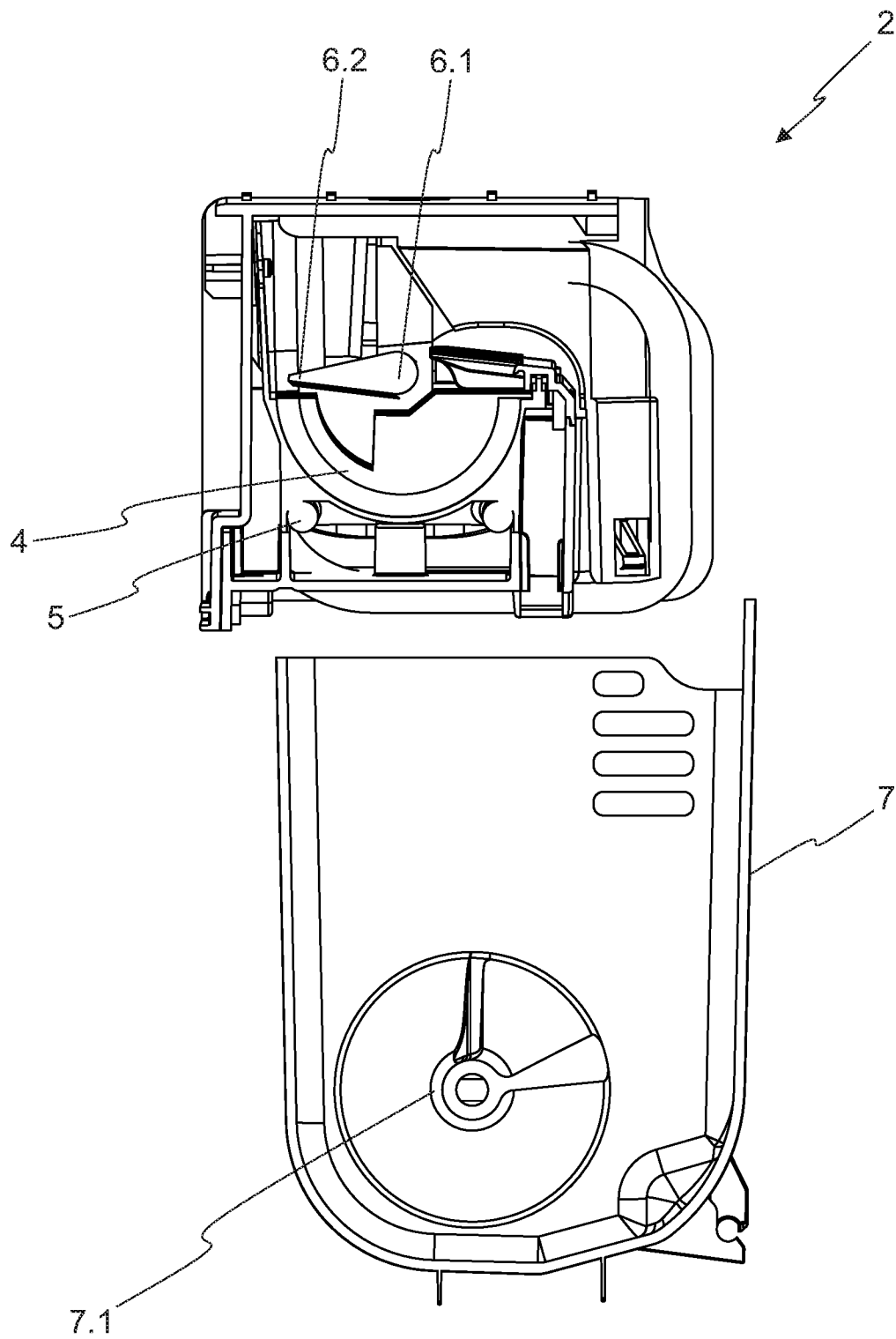


Figure 6

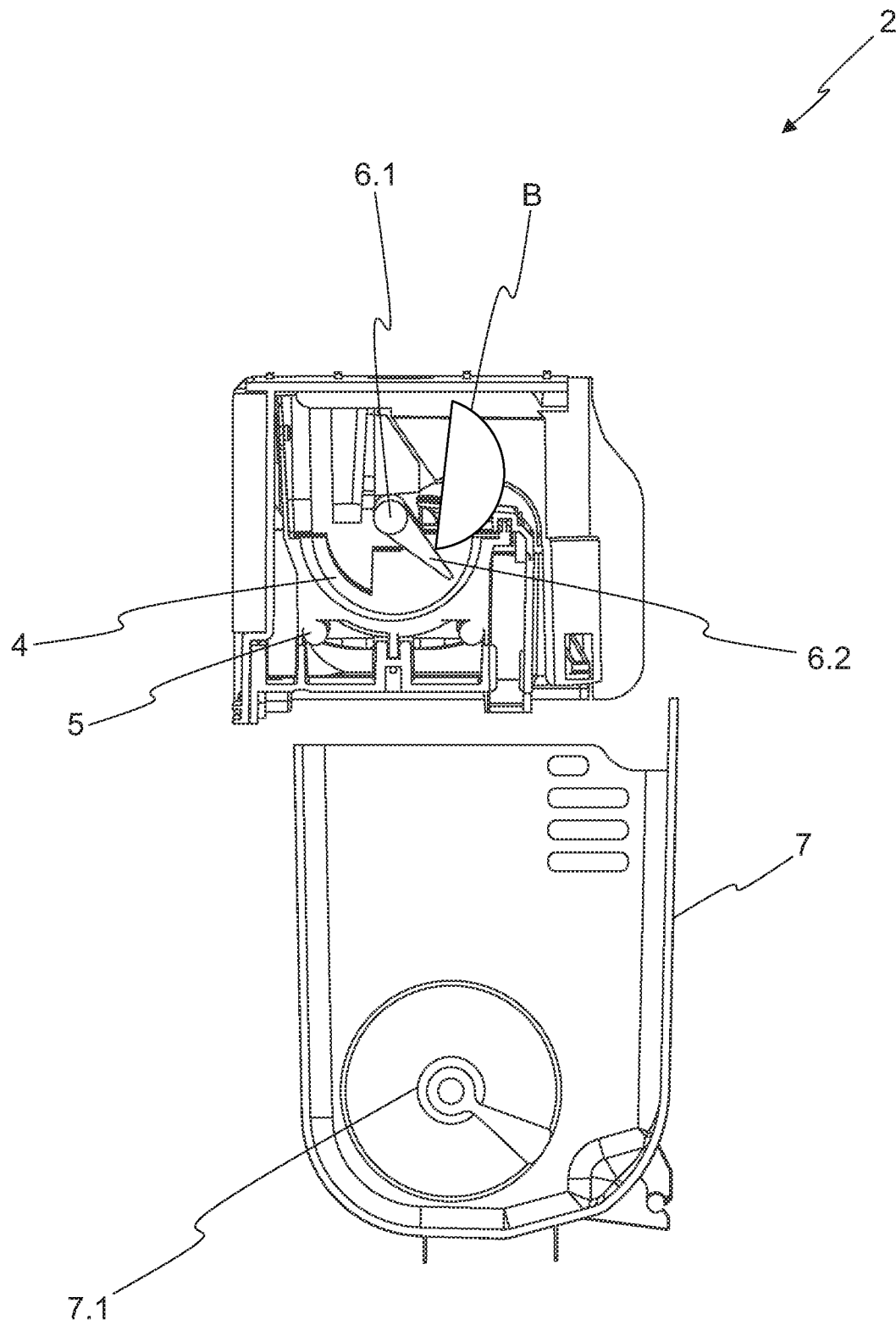


Figure 7

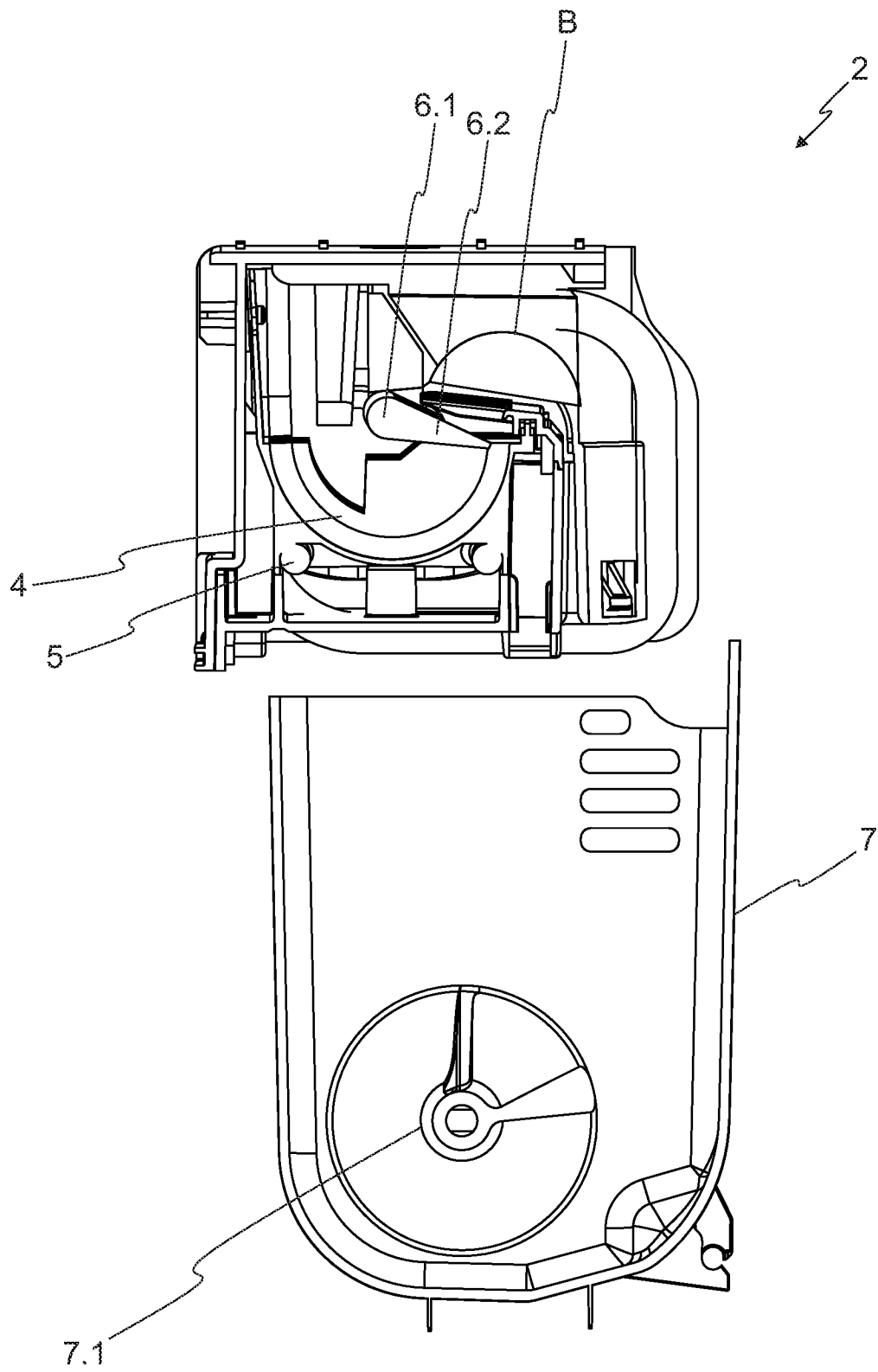


Figure 8

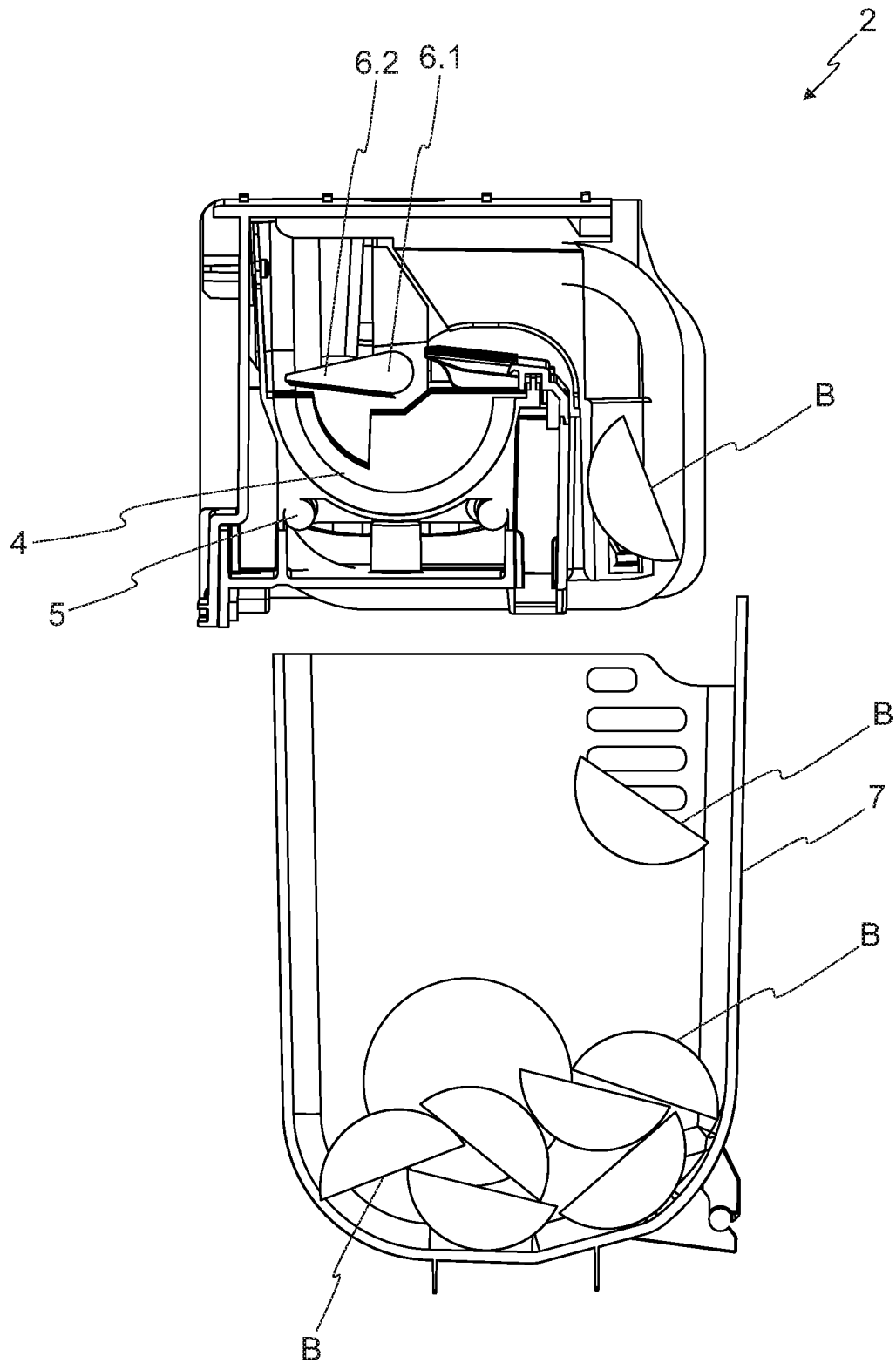


Figure 9

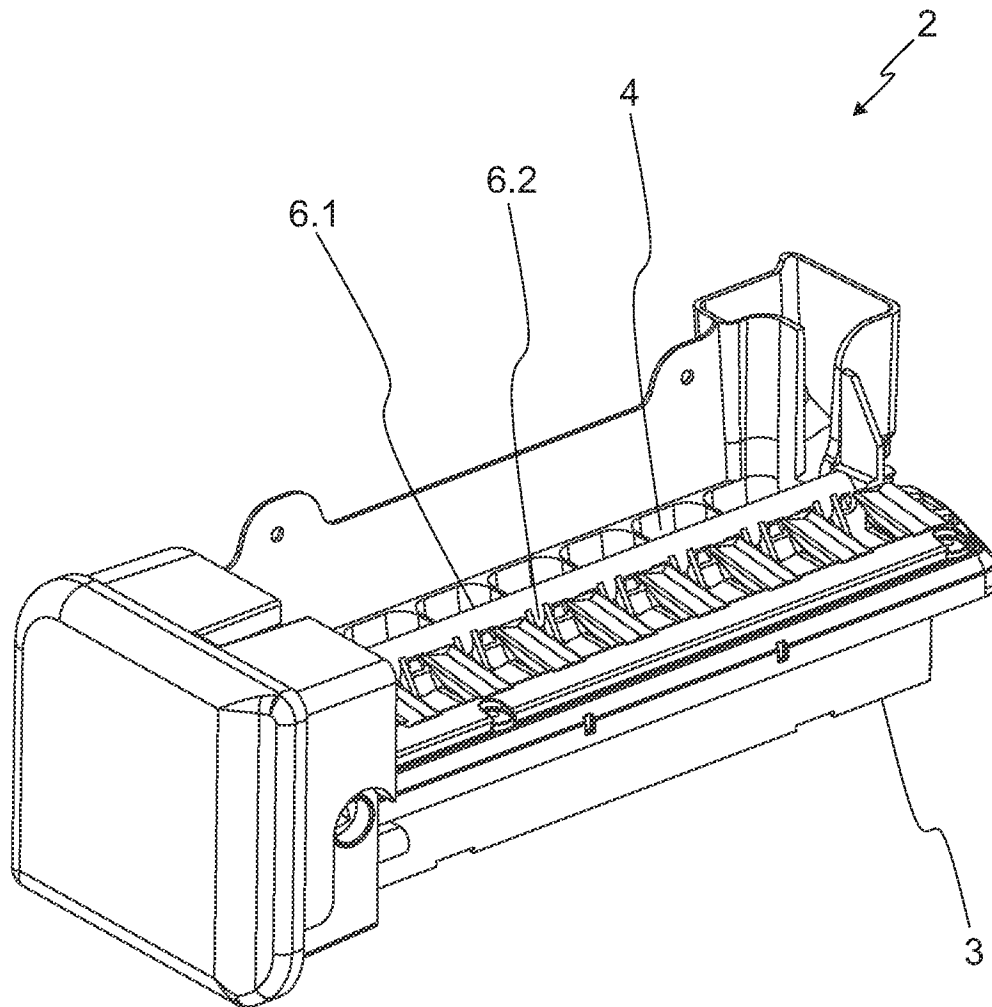


Figure 10

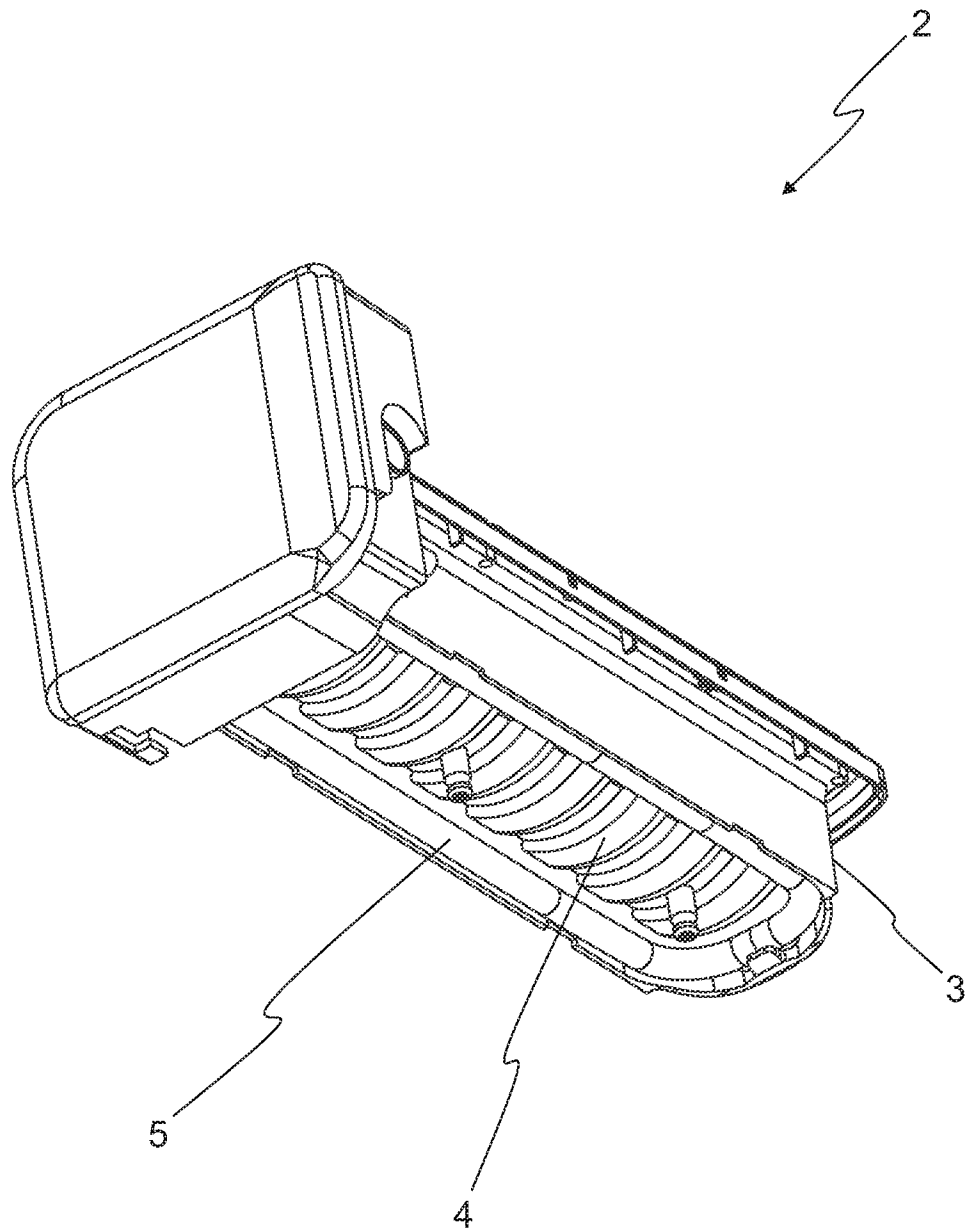


Figure 11

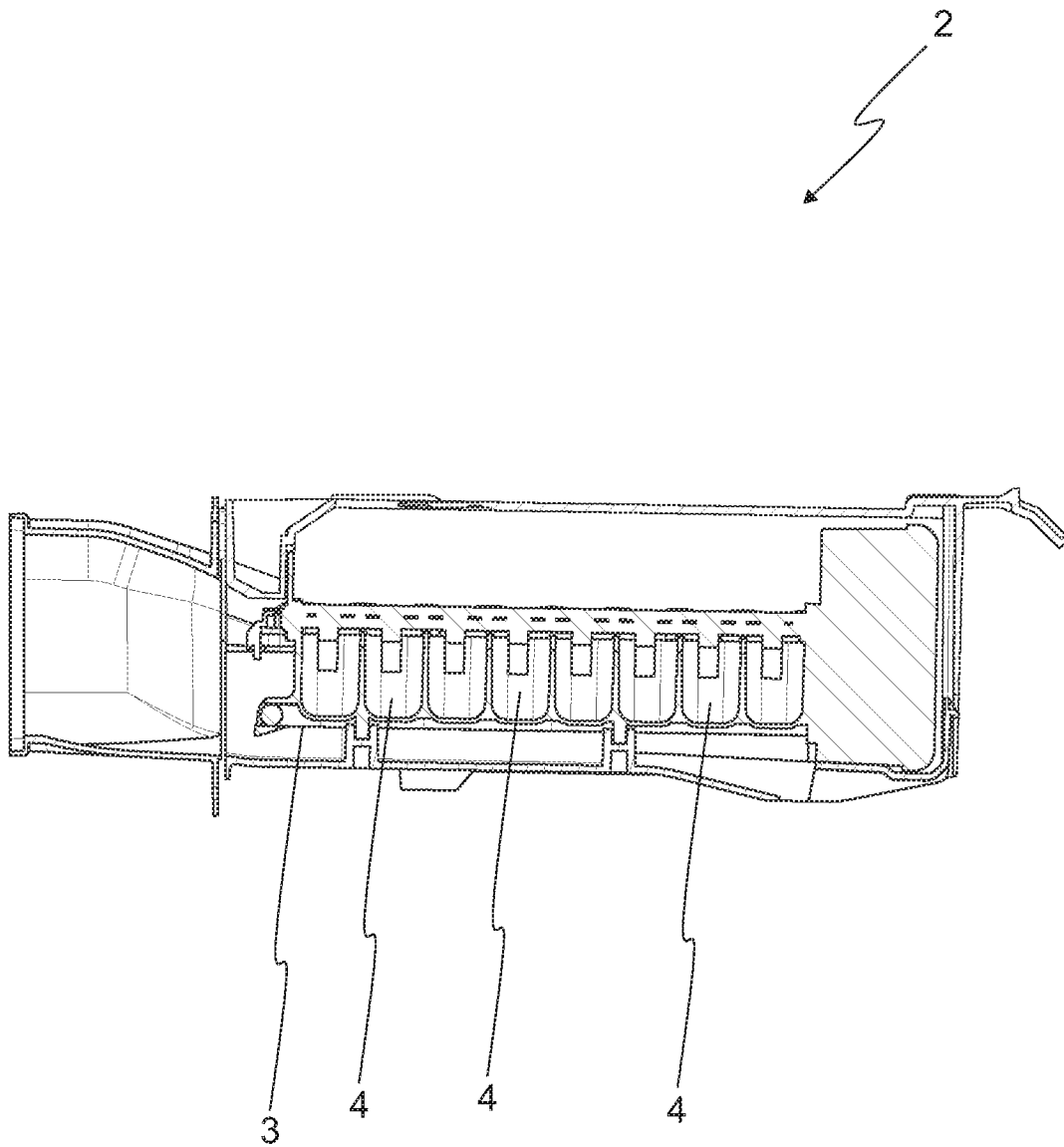


Figure 12

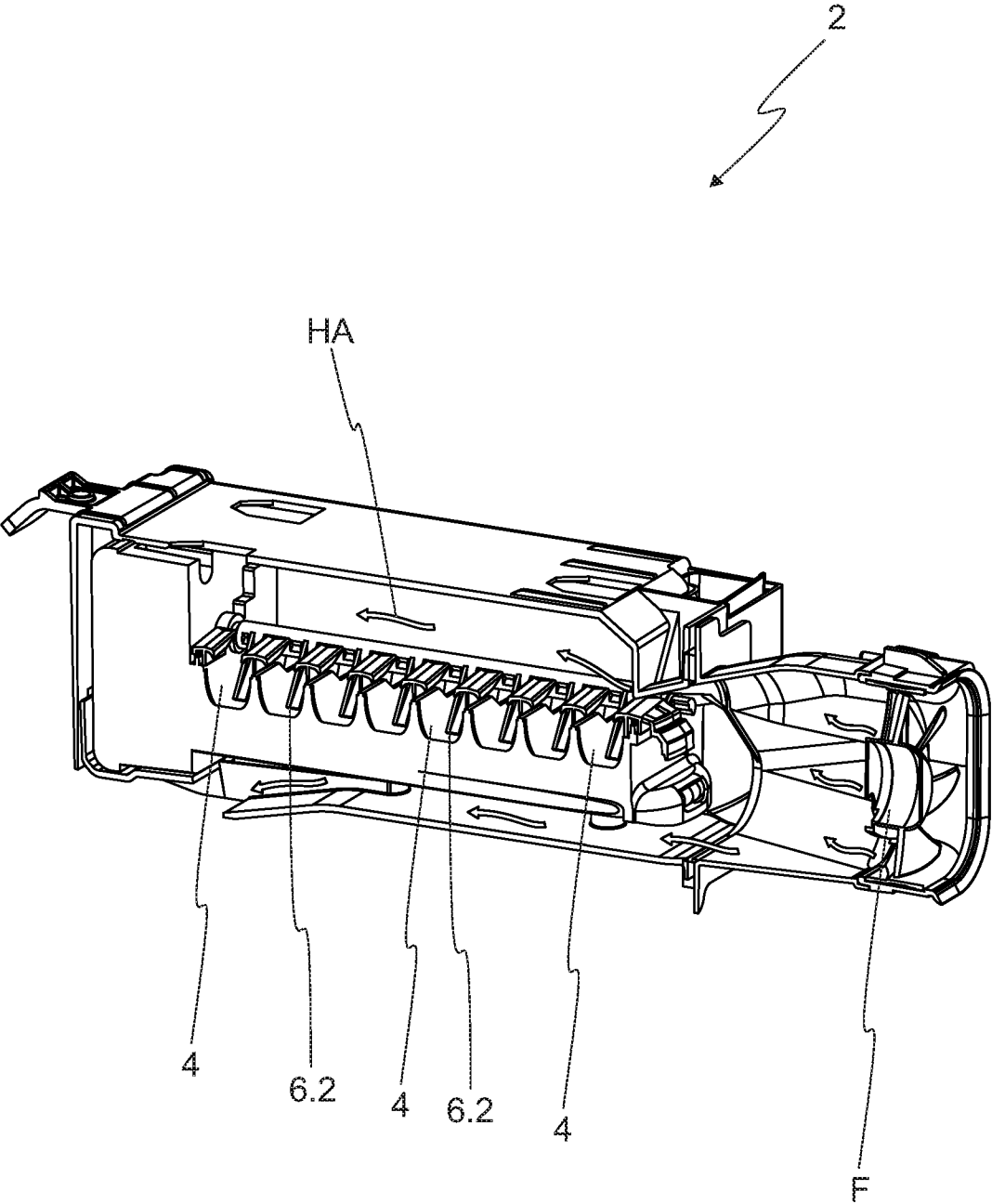
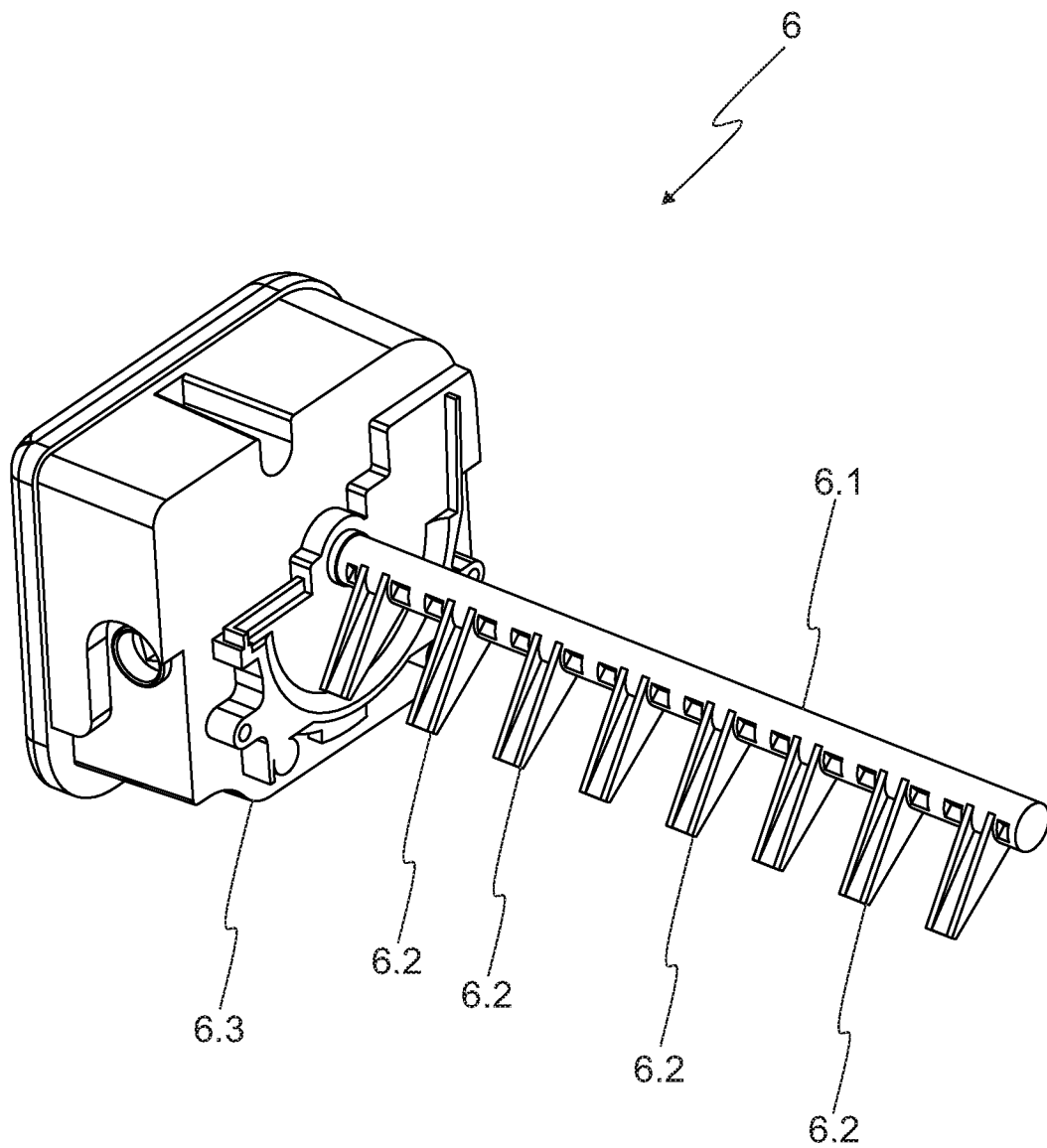


Figure 13



INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

F25C 1/00(2006.01)i; F25C 5/00(2018.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

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EPO Abstract & Fulltext Databases & Keywords: cool, ice, making, unit, temperature, heat, scrap, piece, sense, detect, storage, first, second, separate, start, stop, turn_off, degree, minus, C, speed, control

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 3862671 A1 (LG ELECTRONICS INC [KR]) 11 August 2021 (2021-08-11) Abstract; Paragraphs 31, 36, 75, 264-269	1, 2, 8-10 3-7
X A	KR 20030087170 A (LG ELECTRONICS INC [KR]) 13 November 2003 (2003-11-13) Abstract; Pages 2, 3	1, 2, 8-10 3-7
X A	US 6334318 B1 (JAPAN SERVO [US]) 01 January 2002 (2002-01-01) Abstract; Column 7	1, 2, 8-10 3-7
X A	EP 1522805 A1 (LG ELECTRONICS INC [KR]) 13 April 2005 (2005-04-13) Abstract; Paragraph 102	1, 2, 8-10 3-7



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/TR2024/050845

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