



(51) International Patent Classification:

F25C 1/10 (2006.01) F25D 23/12 (2006.01)
F25C 5/06 (2006.01)

(21) International Application Number:

PCT/CN2024/097189

(22) International Filing Date:

04 June 2024 (04.06.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

18/330,522 07 June 2023 (07.06.2023) US

(71) Applicants: **HAIER SMART HOME CO., LTD.** [CN/CN]; Haier Industrial Park, No. 1 Haier Road, Laoshan District, Qingdao, Shandong 266101 (CN). **QINGDAO HAIER REFRIGERATOR CO., LTD.** [CN/CN]; Haier Industrial Park, No. 1 Haier Road, Laoshan District, Qingdao, Shandong 266101 (CN). **HAIER US APPLIANCE SOLUTIONS, INC.** [US/US]; Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801 (US).

(72) Inventors: **MILLER, Charles Benjamin**; Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801 (US). **MITCHELL, Alan Joseph**; Corporation Trust

Center, 1209 Orange Street, Wilmington, Delaware 19801 (US).

(74) Agent: **ZHIFAN & PARTNERS**; 11th Floor, Linghang Tech. Building, No. 68 Zhichun Road, Haidian District, Beijing 100098 (CN).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE,

(54) Title: ICE MAKING ASSEMBLY WITH ROTATING TRAY

(57) Abstract: An ice making assembly(200) for a refrigerator appliance(100) includes a support frame(250) and a tray(208). A mold cavity(212) is defined in the tray(208). The tray(208) is rotatably mounted inside of the support frame(250). The tray(208) is rotatable between a fill position and a release position. The mold cavity(212) is configured to receive a fill of liquid water and form an ice piece(204) therein when the tray(208) is in the fill position.

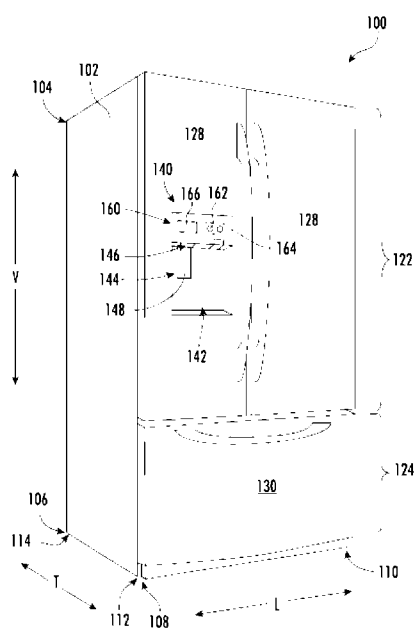


FIG. 1

SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report (Art. 21(3))*

ICE MAKING ASSEMBLY WITH ROTATING TRAY

[0001] This application claims the priority of the US Application No. 18/330,522, filed on June 7, 2023, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

5 [0002] The present subject matter relates generally to refrigerator appliances, and more particularly to ice making assemblies for refrigerator appliances.

BACKGROUND

[0003] Refrigerator appliances generally include a cabinet that defines one or more chilled chambers for receipt of food articles for storage. Typically, one or more doors are rotatably hinged to the cabinet to permit selective access to food items stored in the chilled chamber. Further, refrigerator appliances commonly include ice making assemblies mounted within an icebox on one of the doors or in a freezer compartment. The ice is stored in a storage bin and is accessible from within the freezer chamber or may be discharged through a dispenser recess defined on a front of the refrigerator door.

15 [0004] However, conventional ice making assemblies are large, inefficient, and experience a variety of performance related issues. For example, conventional twist tray icemakers include a partitioned plastic mold that is physically deformed to break the bond formed between ice and the tray. However, these icemakers require additional room to fully twist the tray. In addition, the ice cubes are frequently fractured during the twisting process. When this occurs, a portion of the cubes may remain in the tray, thus resulting in overfilling during the next fill process. Furthermore, such twisting of the relatively rigid tray may induce stresses in the tray which diminish the service life of the tray.

20 [0005] Accordingly, a refrigerator appliance with features for improved ice formation and harvesting would be desirable. More particularly, an ice making assembly for a refrigerator appliance that includes a flexible, resilient tray would be particularly beneficial.

BRIEF DESCRIPTION

25 [0006] Aspects and advantages of the invention will be set forth in part in the following description, or may be apparent from the description, or may be learned through practice of the invention.

[0007] According to an exemplary embodiment, an ice making assembly for a refrigerator appliance is provided. The ice making assembly includes a support frame and a tray with a mold cavity defined therein. The tray is rotatably mounted inside of the support frame, such that the tray is rotatable between a fill position

and a release position. The mold cavity is configured to receive a fill of liquid water and form an ice piece therein when the tray is in the fill position.

[0008] According to another exemplary embodiment, a refrigerator appliance defining a vertical direction, a lateral direction, and a transverse direction is provided. The refrigerator appliance includes a cabinet defining a chilled chamber, a door rotatably mounted to the cabinet to provide selective access to the chilled chamber, and an icebox mounted to the door and defining an ice making chamber. An ice making assembly is positioned within the ice making chamber and includes a support frame and a tray with a mold cavity defined therein. The tray is rotatably mounted inside of the support frame, such that the tray is rotatable between a fill position and a release position. The mold cavity is configured to receive a fill of liquid water and form an ice piece therein when the tray is in the fill position.

[0009] These and other features, aspects and advantages of the present invention will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A full and enabling disclosure of the present invention, including the best mode thereof, directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended figures.

[0011] FIG. 1 provides a perspective view of a refrigerator appliance according to an exemplary embodiment of the present subject matter.

[0012] FIG. 2 provides a perspective view of the exemplary refrigerator appliance of FIG. 1, with the doors of the fresh food chamber shown in an open position.

[0013] FIG. 3 provides a perspective view of an icebox and ice making assembly for use with the exemplary refrigerator appliance of FIG. 1 according to an exemplary embodiment of the present subject matter.

[0014] FIG. 4 provides a top perspective view of a portion of the exemplary ice making assembly of FIG. 3 according to an exemplary embodiment of the present subject matter.

[0015] FIG. 5 provides a bottom perspective view of the portion of the exemplary ice making assembly illustrated in FIG. 4.

[0016] FIG. 6 provides a section side view of the portion of the ice making assembly illustrated in FIGS. 4 and 5 with a tray in a fill position.

[0017] FIG. 7 provides a section side view of the portion of the ice making assembly illustrated in FIGS. 4 and 5 with a tray in a release position.

[0018] FIG. 8 provides an exploded view of the portion of the ice making assembly illustrated in FIGS. 4 and 5.

[0019] FIG. 9 provides a top view of an exemplary tray and motor which may be incorporated into an

ice making assembly according to one or more embodiments of the present disclosure, such as the ice making assembly of FIG. 3.

[0020] FIG. 10 provides a side view of the tray and motor of FIG. 9.

[0021] FIG. 11 provides a perspective view of a tray which may be incorporated into an ice making assembly according to one or more embodiments of the present disclosure, such as the ice making assembly of FIG. 3.

[0022] FIG. 12 provides a top view of the tray of FIG. 11 with a first resilient mold removably received in a heat exchanger thereof.

[0023] FIG. 13 provides a top view of the tray of FIG. 11 with a second resilient mold removably received in the heat exchanger thereof.

[0024] FIG. 14 provides a perspective view of the heat exchanger of FIG. 11.

[0025] FIG. 15 provides a top view of the heat exchanger of FIG. 11.

[0026] FIG. 16 provides a top view of a tray according to one or more additional embodiments of the present disclosure, which may be incorporated into an ice making assembly such as the ice making assembly of FIG. 3.

[0027] FIG. 17 provides a top view of a heat exchanger of the tray of FIG. 16.

[0028] Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

DETAILED DESCRIPTION

[0029] Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0030] Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as “generally,” “about,” “approximately,” and “substantially,” are not to be limited to the precise value specified. In at least some instances, the approximating language may correspond to the precision of an instrument for measuring the value, or the precision of the methods or machines for constructing or manufacturing the components and/or systems. For example, terms of approximation, such as “generally,” or “about” may include values within ten percent greater or less than the stated value. When used in the context of an angle or direction, such terms include within ten degrees greater or less than the stated angle or direction. For example, “generally vertical” includes directions within ten degrees of vertical in any direction, e.g., clockwise or

counterclockwise. As used herein, the terms “first,” “second,” and “third” may be used interchangeably to distinguish one component from another and are not intended to signify location or importance of the individual components.

[0031] As used herein, the terms “includes” and “including” are intended to be inclusive in a manner similar to the term “comprising.” Similarly, the term “or” is generally intended to be inclusive (i.e., “A or B” is intended to mean “A or B or both”). In addition, here and throughout the specification and claims, range limitations may be combined and/or interchanged. Such ranges are identified and include all the sub-ranges contained therein unless context or language indicates otherwise. For example, all ranges disclosed herein are inclusive of the endpoints, and the endpoints are independently combinable with each other. The singular forms “a,” “an,” and “the” include plural references unless the context clearly dictates otherwise.

[0032] FIG. 1 provides a perspective view of a refrigerator appliance 100 according to an exemplary embodiment of the present subject matter. Refrigerator appliance 100 includes a cabinet or housing 102 that extends between a top 104 and a bottom 106 along a vertical direction V, between a first side 108 and a second side 110 along a lateral direction L, and between a front side 112 and a rear side 114 along a transverse direction T. Each of the vertical direction V, lateral direction L, and transverse direction T are mutually perpendicular to one another.

[0033] Housing 102 defines chilled chambers for receipt of food items for storage. In particular, housing 102 defines fresh food chamber 122 positioned at or adjacent top 104 of housing 102 and a freezer chamber 124 arranged at or adjacent bottom 106 of housing 102. As such, refrigerator appliance 100 is generally referred to as a bottom mount refrigerator. It is recognized, however, that the benefits of the present disclosure apply to other types and styles of refrigerator appliances such as, e.g., a top mount refrigerator appliance, a side-by-side style refrigerator appliance, or a single door refrigerator appliance. Consequently, the description set forth herein is for illustrative purposes only and is not intended to be limiting in any aspect to any particular refrigerator chamber configuration.

[0034] Refrigerator doors 128 are rotatably hinged to an edge of housing 102 for selectively accessing fresh food chamber 122. In addition, a freezer door 130 is arranged below refrigerator doors 128 for selectively accessing freezer chamber 124. Freezer door 130 is coupled to a freezer drawer (not shown) slidably mounted within freezer chamber 124. Refrigerator doors 128 and freezer door 130 are shown in the closed configuration in FIG. 1. One skilled in the art will appreciate that other chamber and door configurations are possible and within the scope of the present invention.

[0035] FIG. 2 provides a perspective view of refrigerator appliance 100 shown with refrigerator doors 128 in the open position. As shown in FIG. 2, various storage components are mounted within fresh food chamber 122 to facilitate storage of food items therein as will be understood by those skilled in the art. In particular, the storage components may include bins 134 and shelves 136. Each of these storage components are configured for receipt of food items (e.g., beverages and/or solid food items, etc.) and may assist with organizing such food items. As illustrated, bins 134 may be mounted on refrigerator doors 128 or may slide into a receiving space in fresh food chamber 122. It should be appreciated that the illustrated storage components are used only for the purpose of explanation and that other storage components may be used and

may have different sizes, shapes, and configurations.

[0036] Referring now generally to FIG. 1, a dispensing assembly 140 will be described according to exemplary embodiments of the present subject matter. Dispensing assembly 140 is generally configured for dispensing liquid water and/or ice. Although an exemplary dispensing assembly 140 is illustrated and described herein, it should be appreciated that variations and modifications may be made to dispensing assembly 140 while remaining within the present subject matter.

[0037] Dispensing assembly 140 and its various components may be positioned at least in part within a dispenser recess 142 defined on one of refrigerator doors 128. In this regard, dispenser recess 142 is defined on a front side 112 of refrigerator appliance 100 such that a user may operate dispensing assembly 140 without opening refrigerator door 128. In addition, dispenser recess 142 is positioned at a predetermined elevation convenient for a user to access ice and enabling the user to access ice without the need to bend-over. In the exemplary embodiment, dispenser recess 142 is positioned at a level that approximates the chest level of a user.

[0038] Dispensing assembly 140 includes an ice dispenser 144 including a discharging outlet 146 for discharging ice from dispensing assembly 140. An actuating mechanism 148, shown as a paddle, is mounted below discharging outlet 146 for operating ice or water dispenser 144. In alternative exemplary embodiments, any suitable actuating mechanism may be used to operate ice dispenser 144. For example, ice dispenser 144 can include a sensor (such as an ultrasonic sensor) or a button rather than the paddle. Discharging outlet 146 and actuating mechanism 148 are an external part of ice dispenser 144 and are mounted in dispenser recess 142.

[0039] By contrast, inside refrigerator appliance 100, refrigerator door 128 may define an icebox 150 (FIGS. 2 and 3) housing an icemaker and an ice storage bin 152 that are configured to supply ice to dispenser recess 142. In this regard, for example, icebox 150 may define an ice making chamber 154 for housing an ice making assembly, a storage mechanism, and a dispensing mechanism.

[0040] A control panel 160 is provided for controlling the mode of operation. For example, control panel 160 includes one or more selector inputs 162, such as knobs, buttons, touchscreen interfaces, etc., such as a water dispensing button and an ice-dispensing button, for selecting a desired mode of operation such as crushed or non-crushed ice. In addition, inputs 162 may be used to specify a fill volume or method of operating dispensing assembly 140. In this regard, inputs 162 may be in communication with a processing device or controller 164. Signals generated in controller 164 operate refrigerator appliance 100 and dispensing assembly 140 in response to selector inputs 162. Additionally, a display 166, such as an indicator light or a screen, may be provided on control panel 160. Display 166 may be in communication with controller 164, and may display information in response to signals from controller 164.

[0041] As used herein, “processing device” or “controller” may refer to one or more microprocessors or semiconductor devices and is not restricted necessarily to a single element. The processing device can be programmed to operate refrigerator appliance 100 and dispensing assembly 140. The processing device may include, or be associated with, one or more memory elements (e.g., non-transitory storage media). In some such embodiments, the memory elements include electrically erasable, programmable read only memory

(EEPROM). Generally, the memory elements can store information accessible processing device, including instructions that can be executed by processing device. Optionally, the instructions can be software or any set of instructions and/or data that when executed by the processing device, cause the processing device to perform operations.

5 **[0042]** Referring now generally to FIGS. 3 through 17, an ice making assembly 200 that may be used with refrigerator appliance 100 will be described according to exemplary embodiments of the present subject matter. The ice making assembly 200 is generally positioned within a chilled chamber of the refrigerator appliance 100. In some embodiments, e.g., as illustrated in FIG. 3, ice making assembly 200 may be mounted in icebox 150 within ice making chamber 154. Thus, in some embodiments, the ice making assembly 200
10 may be positioned on the door, such as in the icebox 150 mounted to a fresh food chamber door as illustrated or the ice making assembly 200 may be positioned on a freezer door without an intermediary enclosure, such as without the icebox. In such embodiments where the ice making assembly 200 is positioned on the door, the ice making assembly 200 is positioned within the chilled chamber at least when the door is in the closed position. In additional embodiments, the ice making assembly 200 may be mounted inside of the chilled
15 chamber, such as to one or more walls of the chilled chamber.

[0043] The ice making assembly 200 is configured for receiving a flow of water from a water supply spout 202 (see, e.g., FIG. 3). More specifically, as described in more detail below, water supply spout 202 may discharge a flow of water into a fill cup 214 (FIGS. 6 and 7) that disperses or directs the water into one or more mold cavities.

20 **[0044]** In this manner, ice making assembly 200 is generally configured for freezing the water to form one or more ice pieces 204 (see, e.g., FIG. 7) which may be stored in storage bin 152 and dispensed through discharging outlet 146 by dispensing assembly 140. However, it should be appreciated that ice making assembly 200 is described herein only for the purpose of explaining aspects of the present subject matter. Variations and modifications may be made to ice making assembly 200 while remaining within the scope of
25 the present subject matter. For example, ice making assembly 200 could instead be positioned within freezer chamber 124 of refrigerator appliance 100 and may have any other suitable configurations.

[0045] As will be described in more detail below, the ice making assembly includes a tray 208, and the tray 208 may include a resilient mold 210 and a heat exchanger 220. In addition, ice making assembly 200 may comprise an inlet air duct 224 (FIG. 3) that is positioned adjacent heat exchanger 220 and is fluidly
30 coupled with a cool air supply, e.g., whereby the inlet air duct 224 provides a flow of cooling air to the heat exchanger 220.

[0046] According to the illustrated embodiment, ice making assembly 200 includes a rotatable tray 208, and the rotatable tray 208 includes the heat exchanger 220 and the resilient mold 210. The resilient mold 210 defines one or more mold cavities 212. In general, as described in more detail below, resilient mold 210 is
35 positioned for receiving the gravity-assisted flow of liquid water from water supply spout 202 and containing that liquid water until ice pieces 204 are formed. Resilient mold 210 may be constructed from any suitably resilient material that may be deformed to release ice pieces 204 after formation (an example of such deformation may be seen in FIG. 7). For example, according to the illustrated embodiment, resilient mold

210 is formed from silicone or another suitable hydrophobic, food-grade, and resilient material.

[0047] In some exemplary embodiments, resilient mold 210 defines five mold cavities 212, each being shaped and oriented for forming a separate ice piece 204. In this regard, for example, water supply spout 202 is configured for refilling resilient mold 210 to a level above divider walls (not labelled) within resilient mold 210 such that the water overflows into each of the mold cavities 212 evenly, e.g., evenly into all five mold cavities in the example embodiment illustrated in FIGS. 4-15, or all ten mold cavities in the example embodiments illustrated in FIGS. 16 and 17, or other suitable number of mold cavities as may be provided in various embodiments. In particular, the exemplary embodiment including ten mold cavities is illustrated in FIG. 16, which depicts the tray 208, e.g., including the resilient mold 210 and the heat exchanger 220, and FIG. 17 which depicts the heat exchanger 220. According to still other embodiments, water supply spout 202 could have a dedicated discharge nozzle positioned over each mold cavity 212. Furthermore, it should be appreciated that according to alternative embodiments, ice making assembly 200 may be scaled to form any suitable number of ice pieces 204, e.g., by increasing the number of mold cavities 212 defined by resilient mold 210.

[0048] As may be seen in FIGS. 4 and 5, the tray 208 may be mounted within a support frame 250. For example, the tray 208 may be rotatably mounted inside of the support frame 250, such as mounted to the support frame 250 by a first pivot joint 254 at a first end of the tray 208 and a second pivot joint 256 at a second end of the tray 208 opposite the first pivot joint 254. The first and second pivot joints 254 and 256 may be aligned and colinear to define a pivot axis AP (FIGS. 9 and 10) about which the tray 208 rotates. As may be seen in FIG. 9, the pivot axis AP may be offset from a centerline CL of the tray 208. As illustrated in FIG. 10, the pivot axis AP may be vertically offset from the center of the tray 208 as well, e.g., the pivot axis AP may be positioned at a top of the tray 208 or proximate to the top of the tray 208, where “proximate to the top” includes within the uppermost ten percent of the tray 208, e.g., the uppermost ten percent of a height of the tray 208 where the height of the tray 208 is defined along the vertical direction V.

[0049] As may be seen, e.g., in FIG. 8, the first pivot joint 254 may include a first socket 258 formed on an end of the tray 208, such as on an end of the heat exchanger 220 of the tray 208. The first socket 258 may include at least one linear side, such as the first socket 258 may be polygonal, such as rectangular, in cross-sectional shape. A first pin 260 may be coupled to, e.g., received in, the first socket 258 to form the first pivot joint 254. The first pin 260 may be a drive shaft of a motor 270 or may be coupled to the drive shaft of the motor 270. The first pin 260 is complementarily shaped to fit within the first socket 258, e.g., where the first socket 258 includes at least one straight line side, the first pin 260 includes the same number of straight line sides. Thus, relative rotation within the first pivot joint 254 may be limited or prevented by such geometry, such as rotation of the first pin 260, e.g., when the motor 270 is activated, may be transferred to the first socket 258, thereby rotating the tray 208. The second pivot joint 256 may include a second pin 262 on the heat exchanger 220 and a corresponding second socket 264 in the support frame 250. The second pin 262 and the second socket 264 may be curvilinear in cross-sectional shape, such as circular in cross-section, such as cylindrical. Thus, relative rotation between the second pin 262 and the second socket 264 may be permitted, e.g., such that the tray 208 (including the second pin 262 thereon) may rotate within the

support frame 250. Further, the second pivot joint 256 may be a passive pivot joint, e.g., may simply permit rotation of the second pin 262 within the second socket 264, such as a passive pivot joint without any actuation or restriction at the second pivot joint 256. Thus, the entire tray 208 may be rotated at the same time, in the same direction, and generally the same amount, e.g., generally the same number of degrees, when the motor 270 is activated to rotate the tray 208 between the fill position and the release position. For example, the entire tray 208 may rotate the same amount except for the resilient mold 210, or portions of the resilient mold 210, which is or are inhibited from the full rotation by encountering cross beams 252 of the support frame 250, as described below. Thus, the entire tray 208 may rotate between the fill position and the release position in a single direction and without twisting or any differential rotation between components of the tray 208. In additional embodiments, the relative position of each pin or socket in either or both of the first and second pivot joints 254 and 256 may be reversed, e.g., the second pin 262 may be provided on the support frame 250 and the second socket 264 on the tray 208. Additional variations are also possible within the scope of the present disclosure, such as variations in the shape or size of one or both of the pivot joints 254 and 256.

[0050] The ice making assembly 200 may include a drive mechanism, e.g., comprising the motor 270, which is operably coupled to the tray 208 to selectively rotate the tray 208 during operation, e.g., operatively coupled to the tray 208 via the first pivot joint 254 as described above. As used herein, “motor” may refer to any suitable drive motor and/or transmission assembly for rotating a system component. For example, motor 270 may be a brushless DC electric motor, a stepper motor, or any other suitable type or configuration of motor. Alternatively, for example, motor 270 may be an AC motor, an induction motor, a permanent magnet synchronous motor, or any other suitable type of AC motor. In addition, motor 270 may include any suitable transmission assemblies, clutch mechanisms, or other components.

[0051] As shown, the ice making assembly 200 further includes a fill cup 214 that is positioned above resilient mold 210 for selectively filling the mold cavities 212 with water. More specifically, fill cup 214 may be positioned below water supply spout 202 for receiving a flow of liquid water. For example, the fill cup 214 below the water supply spout 202 is illustrated in FIGS. 6 and 7, it being understood that only a lowermost portion of the water supply spout 202 is depicted in FIGS. 6 and 7. The fill cup 214 may define a small reservoir for collecting and/or directing the flow of liquid water into mold cavity 212 without excessive splashing or spilling. In addition, fill cup 214 may define a discharge spout 218 (FIG. 7) that funnels liquid water toward the bottom of the fill cup 214 where it may be dispensed into mold cavity 212.

[0052] In general, fill cup 214 and discharge spout 218 may have any suitable size, shape, and configuration suitable for dispensing the flow of water into resilient mold 210. For example, according to the illustrated embodiment, fill cup 214 is positioned over one of the mold cavities 212 and generally defines sloped surfaces for directing the flow of water to discharge spout 218 immediately above a fill level (not labeled) of the resilient mold 210. According to alternative embodiments, fill cup 214 may extend across a width of the entire resilient mold 210 and may have multiple discharge spouts 218. Fill cup 214 may have still other configurations while remaining within the scope of the present subject matter.

[0053] Ice making assembly 200 may further include a heat exchanger 220 which is in thermal communication with resilient mold 210 for freezing the water within mold cavities 212 to form one or more

ice pieces 204. For example, the resilient mold 210 may be removably inserted into the heat exchanger 220 to form the tray 208 of the ice making assembly 200. The resilient mold 210 may be removable from the tray 208, e.g., from the heat exchanger 220, for cleaning or to provide additional alternative resilient molds, such as an alternative resilient mold including a different number, size, or shape of mold cavities therein (see, e.g., FIG. 13). For example, the resilient mold 210 may include one or more tabs 272 (FIG. 11) which are engaged with a corresponding number and size of slots in the heat exchanger 220. Thus, the resilient mold 210 may be removable from the heat exchanger 220 by pulling the resilient mold 210 to deform the one or more tabs 272 until the tab(s) 272 release from the heat exchanger 220. For example, the tray 208 may be rotatable to an access position, such as between the fill position and the release position, in order to permit a user to grasp the resilient mold 210 and pull the resilient mold 210 out of the heat exchanger 220 or reinsert the resilient mold 210 into the heat exchanger 220. In general, heat exchanger 220 may be formed from any suitable thermally conductive material and may be positioned in direct contact with resilient mold 210. Specifically, according to the illustrated embodiment, heat exchanger 220 is formed from aluminum and is in direct contact with resilient mold 210 when the resilient mold 210 is received within the heat exchanger 220. In this manner, heat exchanger 220 is in direct contact with resilient mold 210 over a large portion of the surface area of ice pieces 204, e.g., to facilitate an increased rate of heat transfer and quick freezing of the water stored within mold cavities 212. For example, heat exchanger 220 may contact resilient mold 210 over greater than approximately half of the surface area of each mold cavity 212 and/or each ice piece 204 in each respective mold cavity. It should be appreciated that as used herein terms of approximation, such as “approximately,” “substantially,” or “about,” refer to being within a ten percent margin of error, e.g., “approximately half” includes between forty-five percent and fifty-five percent.

[0054] As may be seen, e.g., in FIGS. 11 and 14, heat exchanger 220 defines a plurality of heat exchange fins 232 that extend substantially parallel to the vertical direction V, e.g., downward when the tray 208 is in the fill position and upward when the tray 208 is in the release position (e.g., as illustrated in FIG. 7, where the fins 232 extend above the cross beams 252 of the support frame 250 while each cross beam 252 is within a respective slot 234). As will be understood by those of ordinary skill in the art, inlet air duct 224 (FIG. 3) generally receives a flow of cooling air from a sealed system of refrigerator appliance 100 and directs the cooling air over and through heat exchanger 220 to cool heat exchanger 220. The heat exchange fins 232 may define air passages between adjacent pairs of heat exchange fins 232, and may provide an increased (e.g., as compared to a heat exchanger with flat sides and without fins) surface area for contact between the heat exchanger 220 and the flow of cooling air, thus promoting improved, e.g., more rapid, heat exchange between the cooling air and the heat exchanger 220. According to the illustrated embodiment, inlet air duct 224 provides a flow of cooling air across the ice making assembly 200, e.g., generally into the page as shown in FIG. 11, through heat exchanger 220, such as in a direction generally parallel to the heat exchange fins 232 when the tray 208 is in the fill position, whereby the flow of cooling air is directed across, through, and/or between the heat exchange fins 232. Thus, the heat exchanger 220 may be cooled by the flow of cooling air and the heat exchanger 220 may, in turn, receive thermal energy from the resilient mold 210 and water therein, such that the temperature of the water in the resilient tray mold is reduced due to the contact between the resilient mold 210 and the heat exchanger 220, promoting the formation of ice pieces 204 within

the resilient mold 210.

[0055] As is generally understood in the art, a temperature sensor may be mounted to the tray 208 and may be used to determine when ice pieces 204 have been formed such that an ejection process may be performed. In this regard, for example, the temperature sensor may be in operative communication with controller 164 which may monitor the temperature of heat exchanger 220 and the time water has been in mold cavities 212 to predict when ice pieces 204 have been fully frozen. As used herein, “temperature sensor” may refer to any suitable type of temperature sensor. For example, the temperature sensors may be thermocouples, thermistors, or resistance temperature detectors. For example, the temperature sensor may, in some embodiments, be a thermistor 216 which is received within a slot in the heat exchanger 220, e.g., as illustrated in FIG. 6. In addition, it should be appreciated that ice making assembly 200 may include any suitable number, type, and position of temperature sensors according to alternative embodiments.

[0056] The ejection process may include rotating the tray 208 to the release position (FIG. 7), whereupon the ice pieces 204 are released from the resilient mold 210. For example, the tray 208 may be in the fill position (FIG. 6) when liquid water is flowed thereto, e.g. directed into the mold cavities 212 by the fill cup 214, and may remain in the fill position while the liquid water is frozen, e.g., thereby forming one or more ice pieces 204 in the resilient mold 210. When the ice pieces 204 are determined to be ready for harvesting, e.g., based on the measured temperature of the tray 208, such as the heat exchanger 220 thereof, the tray 208 may then be rotated. For example, the motor 270 may be activated to rotate the tray 208 about the pivot axis AP from the fill position (FIG. 6) to the release position (FIG. 7). According to an exemplary embodiment of the present subject matter, motor 270 may begin to rotate after ice pieces 204 are completely frozen and ready for harvest. In this regard, motor 170 rotates the tray 208 approximately one hundred and eighty degrees to move the tray 208 from the fill position to the release position.

[0057] As may be seen, e.g., in FIGS. 4-8, the support frame 250 may include a plurality of cross beams 252. The cross beams 252 may correspond in number to the mold cavities 212, such as five cross beams 252 for the five mold cavities 212 in the exemplary embodiments illustrated in FIGS. 4-8. The heat exchange fins 232 may be formed in an array across one side of the heat exchanger 220, such as in a discontinuous array. For example, the heat exchange fins 232 may be provided in multiple groups, with each group of heat exchange fins 232 separated from adjacent heat exchange fins 232 by at least one slot 234 in the heat exchanger 220, e.g., as illustrated in FIGS. 11 and 14, and the slots 234 may also be seen in FIGS. 15 and 17. When the resilient mold 210 is received in the heat exchanger 220, each slot 234 may be positioned generally directly below a center of a respective mold cavity 212 and may extend across, such as fully across, at least one dimension of the respective mold cavity 212. For example, each slot 234 may be “generally directly” below the center of a respective mold cavity 212 when the slot 234 is offset from the center of the respective mold cavity 212 by no more than ten percent of a dimension of the mold cavity 212 in any corresponding direction, e.g., no more than ten percent of the width of the mold cavity 212 in the direction along which the width is measured.

[0058] As best seen in FIG. 7, when the tray 208 is rotated to the release position, the cross beams 252 of the support frame 250 pass through the heat exchanger 220, such as partially through the heat exchanger

220 in the vertical direction V and fully through the heat exchanger 220 in a direction perpendicular to the vertical direction V, in each slot 234 of the heat exchanger 220. Each cross beam 252, when the tray 208 is in the release position, contacts the bottom of the resilient mold 210 at a respective mold cavity 212 and bears on the resilient mold 210, thereby deforming resilient mold 210 and releasing ice pieces 204, e.g., pushing each ice piece 204 out of each respective mold cavity 212. Ice pieces 204 may fall, e.g., by gravity, downward from the deformed resilient mold 210 into storage bin 152 therebelow.

[0059] As noted, various modifications may be made to the present disclosure without departing from the scope thereof. For example, as illustrated in FIG. 13, the mold cavities 212 may have a variety of shapes, such as star shaped as in the exemplary embodiment of FIG. 13.

[0060] It is noted that although these exemplary embodiments are explicitly illustrated, one of ordinary skill in the art would understand that additional or alternative embodiments or configurations may be provided to include one or more features of these examples.

[0061] Although a specific configuration and operation of ice making assembly 200 is described above, it should be appreciated that this is provided only for the purpose of explaining aspects of the present subject matter. Modifications and variations may be applied, other configurations may be used, and the resulting configurations may remain within the scope of the invention. For example, resilient mold 210 may define any suitable number of mold cavities 212, or the drive mechanism may have a different configuration. Furthermore, other control methods may be used to form and harvest ice pieces 204. One skilled in the art will appreciate that such modifications and variations may remain within the scope of the present subject matter.

[0062] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

CLAIMS

1. An ice making assembly for a refrigerator appliance, the ice making assembly comprising:
a support frame; and

a tray with a mold cavity defined therein, the tray rotatably mounted inside of the support frame by a first pivot joint at a first end of the tray and second pivot joint at a second end of the tray, wherein the second pivot joint is a passive pivot joint, whereby the entire tray is rotatable in a single direction between a fill position and a release position, the mold cavity configured to receive a fill of liquid water and form an ice piece therein when the tray is in the fill position.

2. The ice making assembly of claim 1, wherein the tray comprises a resilient mold, the mold cavity defined in the resilient mold, wherein the support frame comprises a cross beam, and wherein the cross beam engages the resilient mold when the tray is in the release position, whereby the resilient mold is deformed to release the ice piece from the resilient mold in the release position.

3. The ice making assembly of claim 2, wherein the tray further comprises a heat exchanger in thermal communication with the resilient mold to freeze the liquid water and thereby form the ice piece in the mold cavity.

4. The ice making assembly of claim 3, wherein the heat exchanger comprises a slot, wherein the cross beam of the support frame extends through the slot when the tray is in the release position.

5. The ice making assembly of claim 3, wherein the resilient mold is removably mounted to the heat exchanger.

6. The ice making assembly of claim 5, wherein the tray is rotatable to an access position for accessing the resilient mold.

7. The ice making assembly of any one of claims 1 to 6, further comprising a fill cup positioned above the mold cavity for selectively filling the mold cavity with the liquid water when the tray is in the fill position.

8. The ice making assembly of any one of claims 1 to 7, wherein the fill position is approximately one hundred and eighty degrees from the release position.

9. The ice making assembly of any one of claims 1 to 8, wherein the mold cavity comprises an open end, the open end oriented upwards in the fill position and oriented downwards in the release position, whereby the ice piece falls out of the mold cavity in the release position.

10. A refrigerator appliance defining a vertical direction, a lateral direction, and a transverse direction, comprising:

a cabinet defining a chilled chamber;

a door rotatably mounted to the cabinet to provide selective access to the chilled chamber;

an ice making assembly positioned within the chilled chamber, the ice making assembly comprising:

a support frame; and

a tray with a mold cavity defined therein, the tray rotatably mounted inside of the support frame by a first pivot joint at a first end of the tray and second pivot joint at a second end of the tray, wherein the second pivot joint is a passive pivot joint, whereby the entire tray is rotatable in a single direction between a fill position and a release position, the mold cavity configured to receive a fill of liquid water

and form an ice piece therein when the tray is in the fill position.

11. The refrigerator appliance of claim 10, wherein the tray comprises a resilient mold, the mold cavity defined in the resilient mold, wherein the support frame comprises a cross beam, and wherein the cross beam engages the resilient mold when the tray is in the release position, whereby the resilient mold is deformed to release the ice piece from the resilient mold in the release position.

12. The refrigerator appliance of claim 11, wherein the tray further comprises a heat exchanger in thermal communication with the resilient mold to freeze the liquid water and thereby form the ice piece in the mold cavity.

13. The refrigerator appliance of claim 12, wherein the heat exchanger comprises a slot, wherein the cross beam of the support frame extends through the slot when the tray is in the release position.

14. The refrigerator appliance of claim 12, wherein the resilient mold is removably mounted to the heat exchanger.

15. The refrigerator appliance of claim 14, wherein the tray is rotatable to an access position for accessing the resilient mold.

16. The refrigerator appliance of any one of claims 10 to 15, further comprising a fill cup positioned above the mold cavity for selectively filling the mold cavity with the liquid water when the tray is in the fill position.

17. The refrigerator appliance of any one of claims 10 to 16, wherein the fill position is approximately one hundred and eighty degrees from the release position.

18. The refrigerator appliance of any one of claims 10 to 17, wherein the mold cavity comprises an open end, the open end oriented upwards along the vertical direction in the fill position and oriented downwards along the vertical direction in the release position, whereby the ice piece falls out of the mold cavity in the release position.

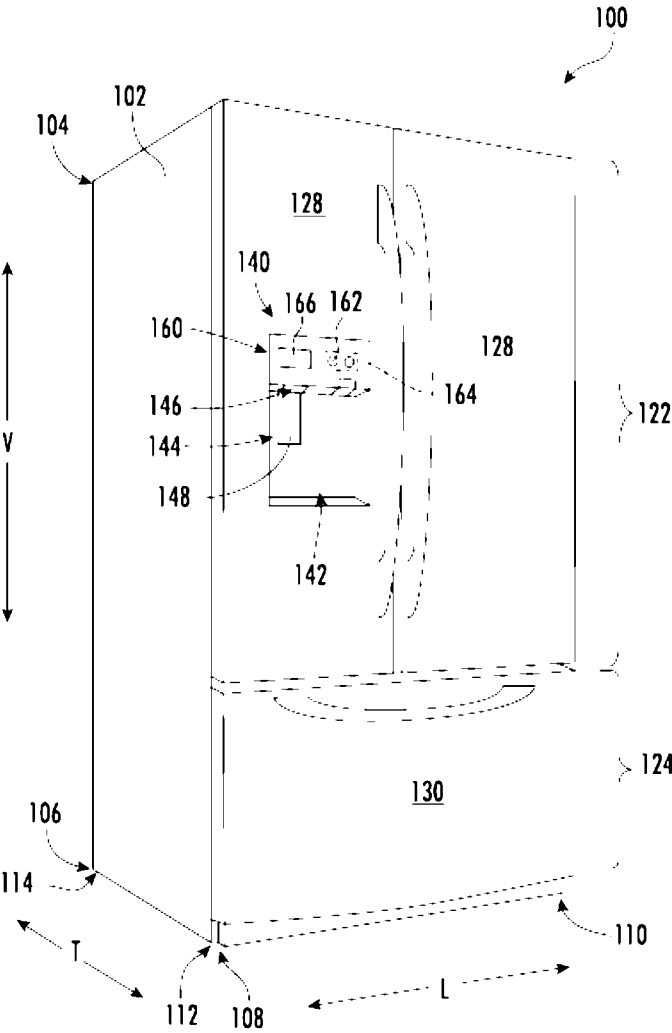


FIG. 1

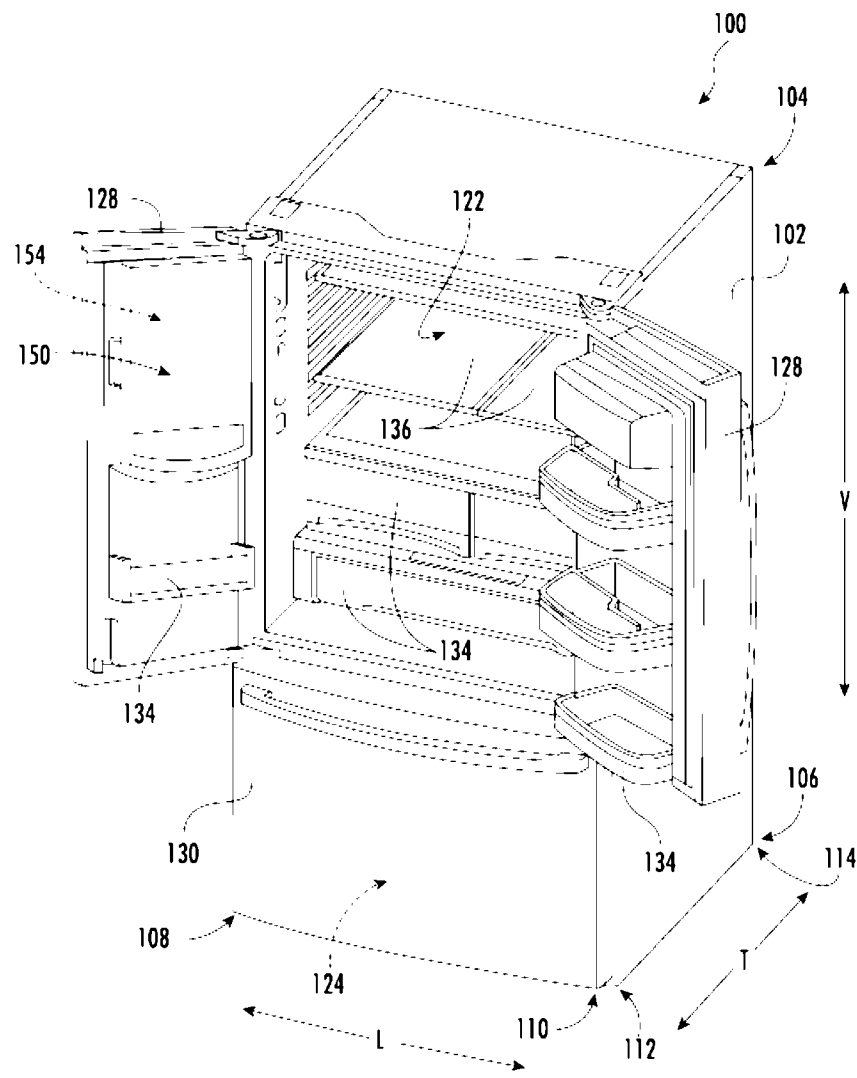


FIG. 2

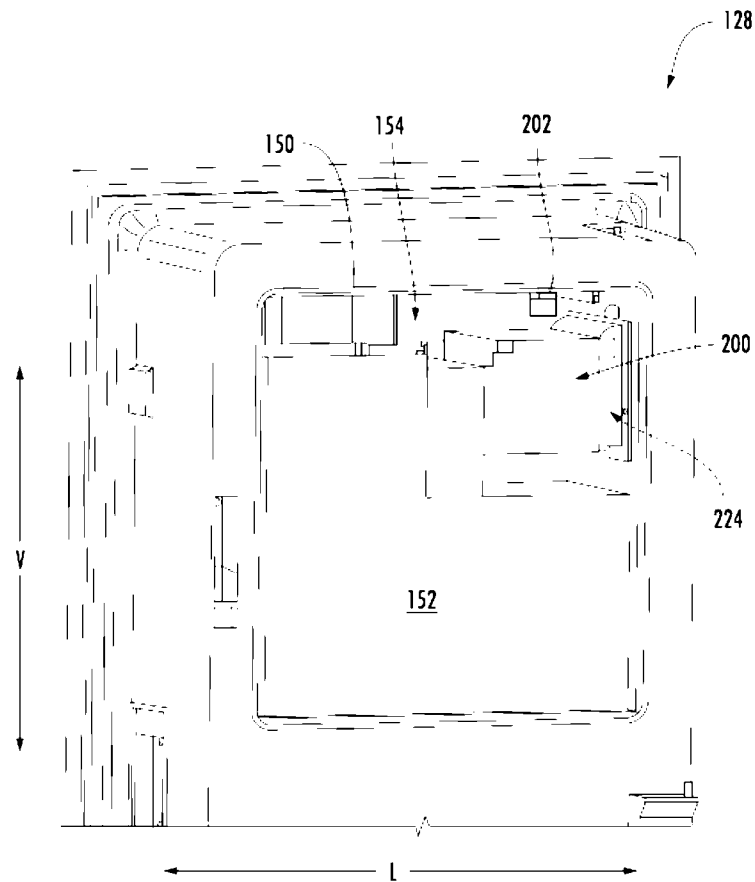


FIG. 3

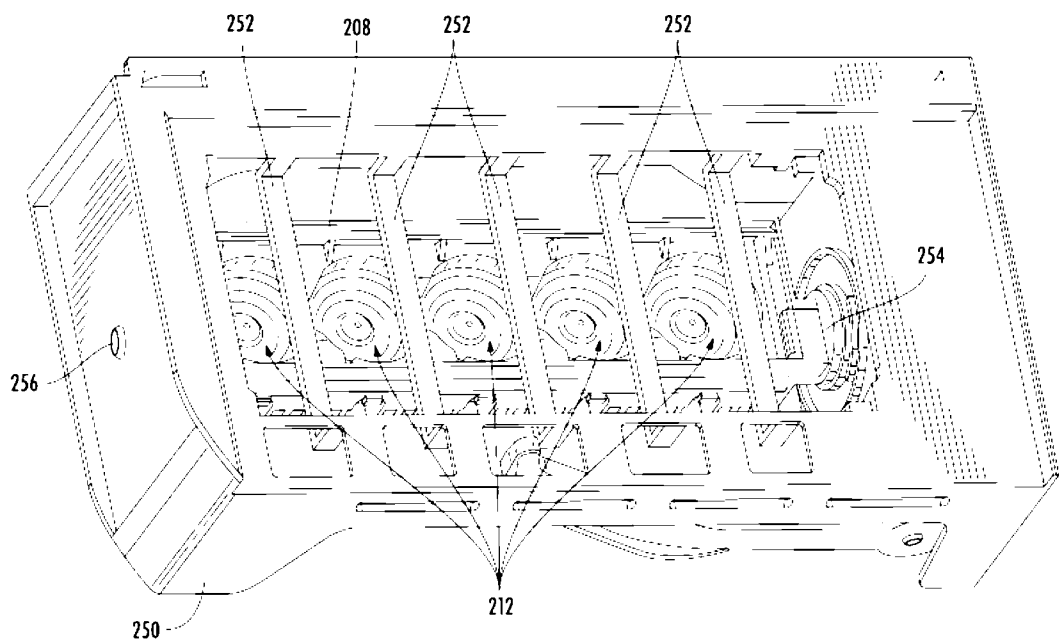


FIG. 4

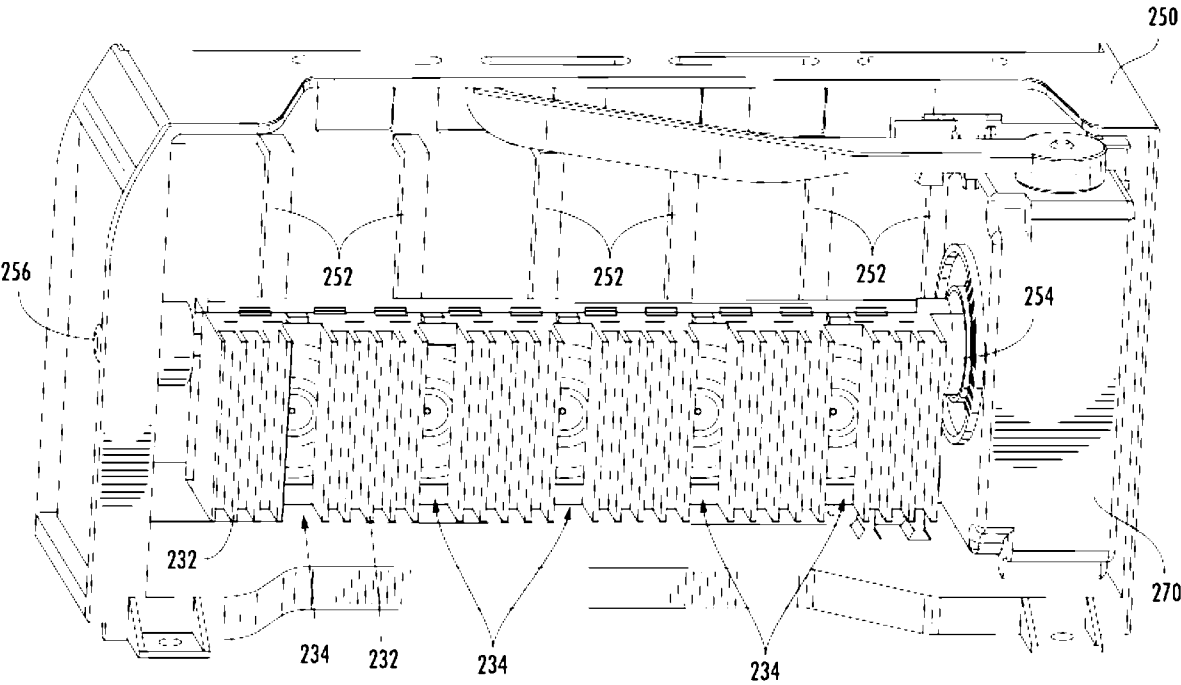


FIG. 5

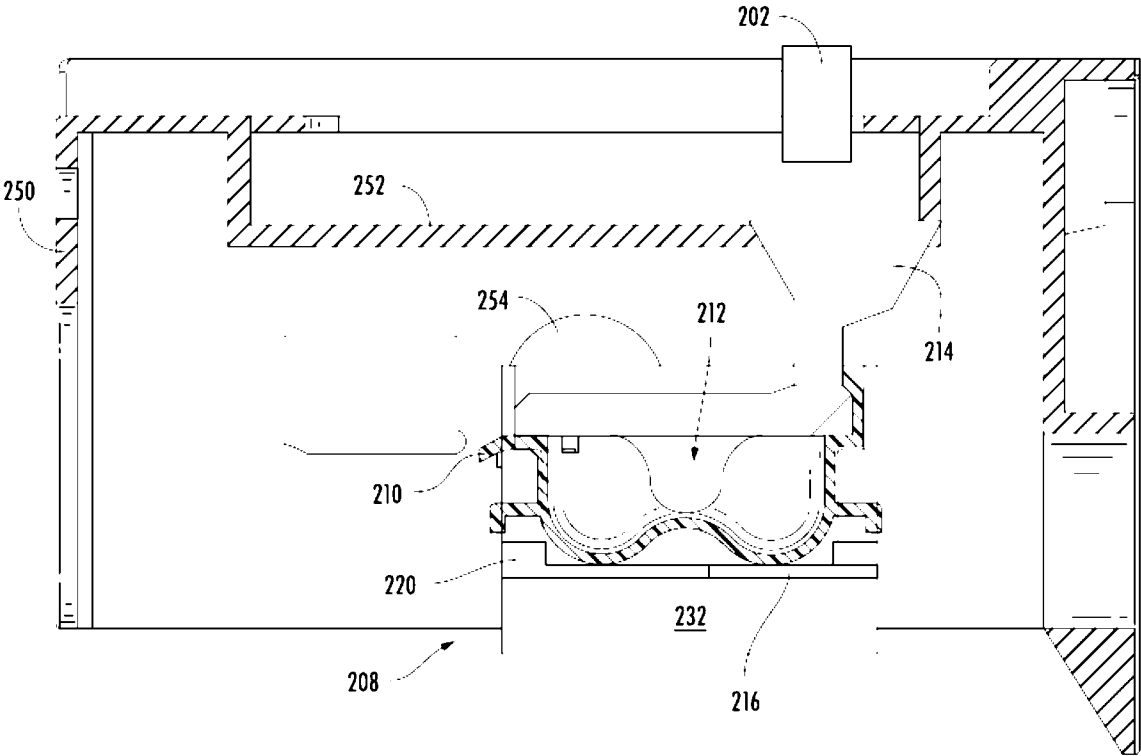


FIG. 6

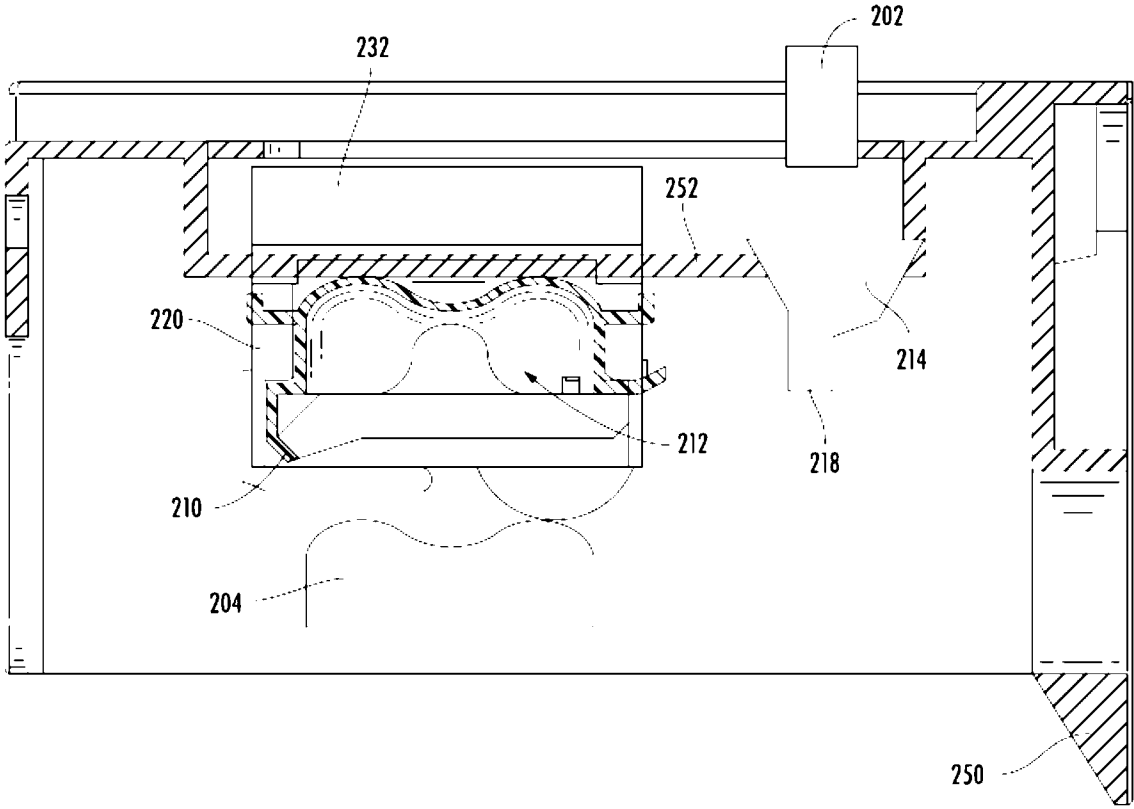


FIG. 7

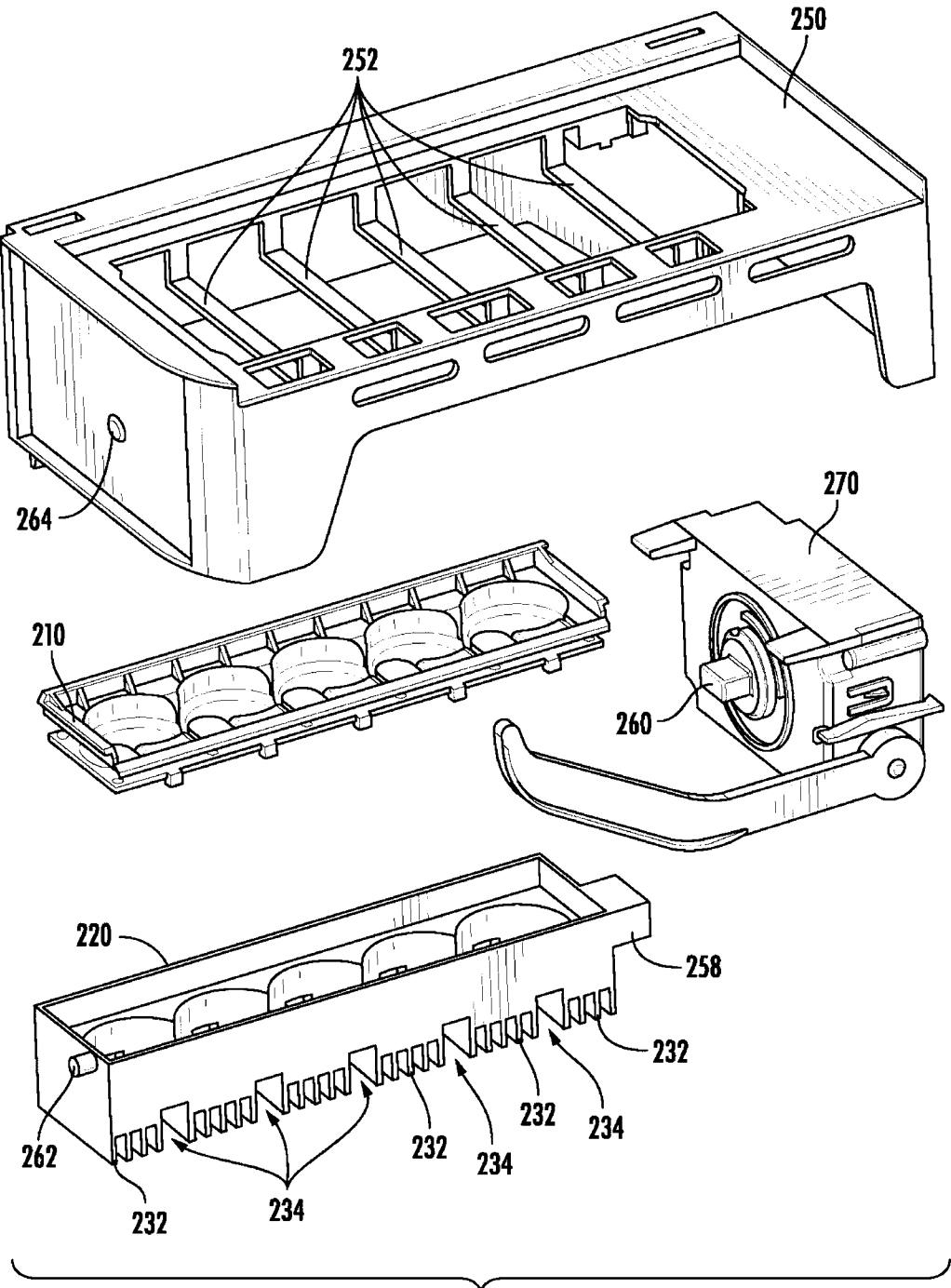


FIG. 8

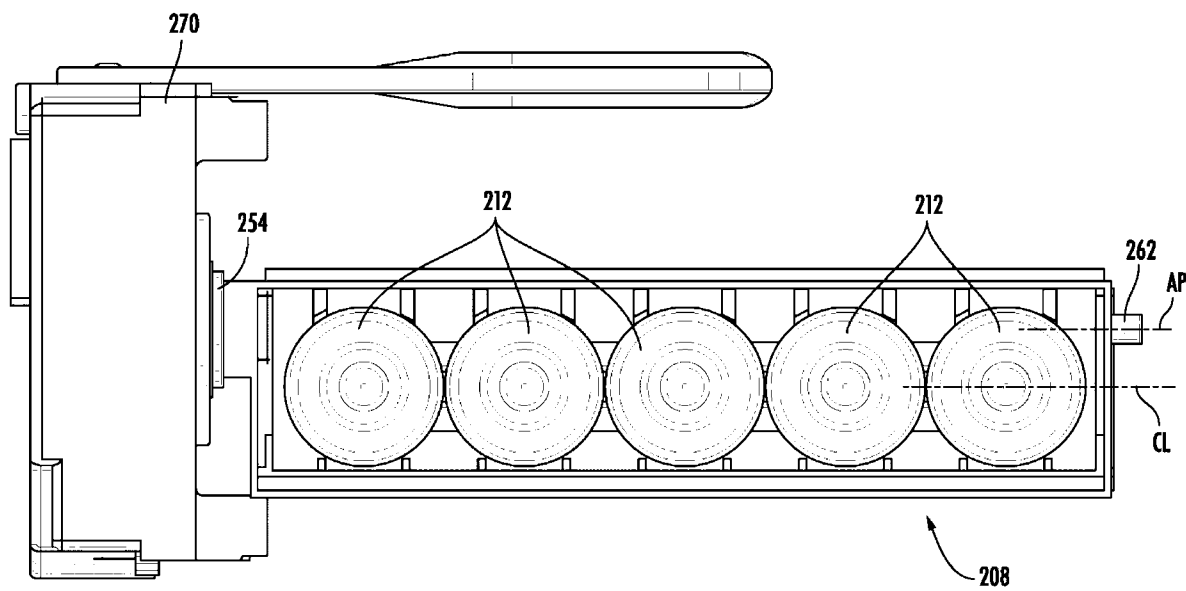


FIG. 9

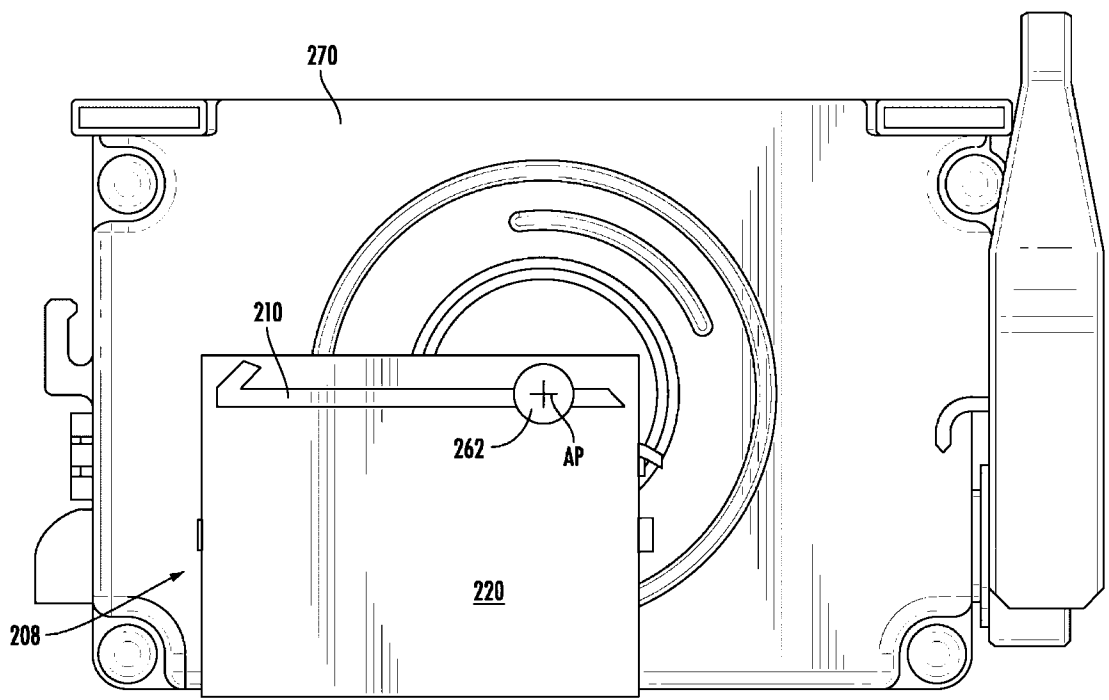


FIG. 10

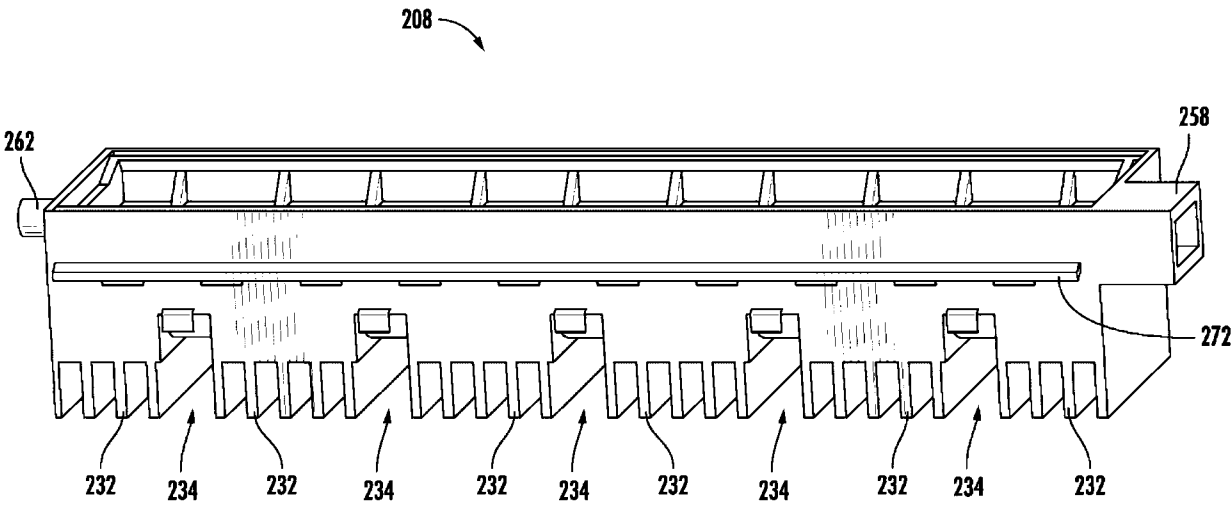


FIG. 11

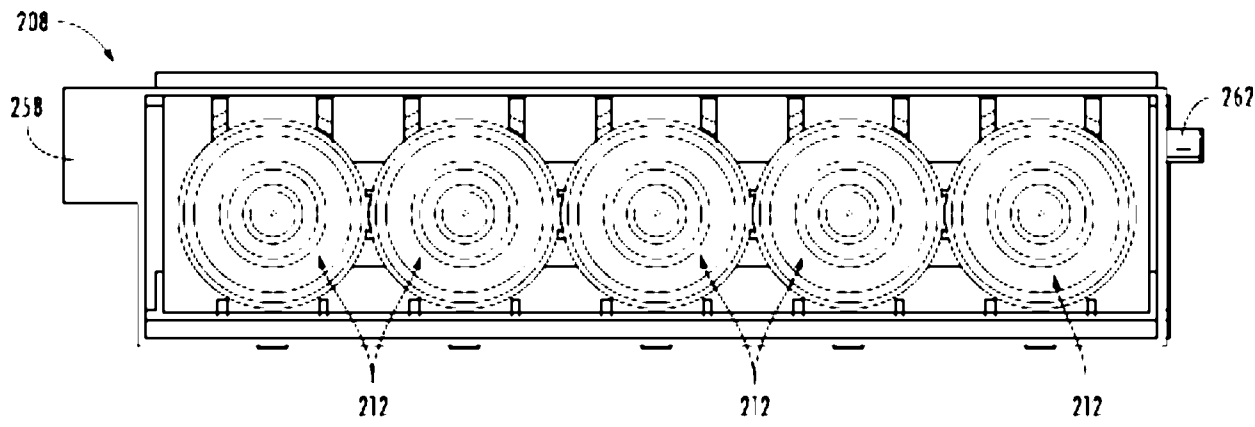


FIG. 12

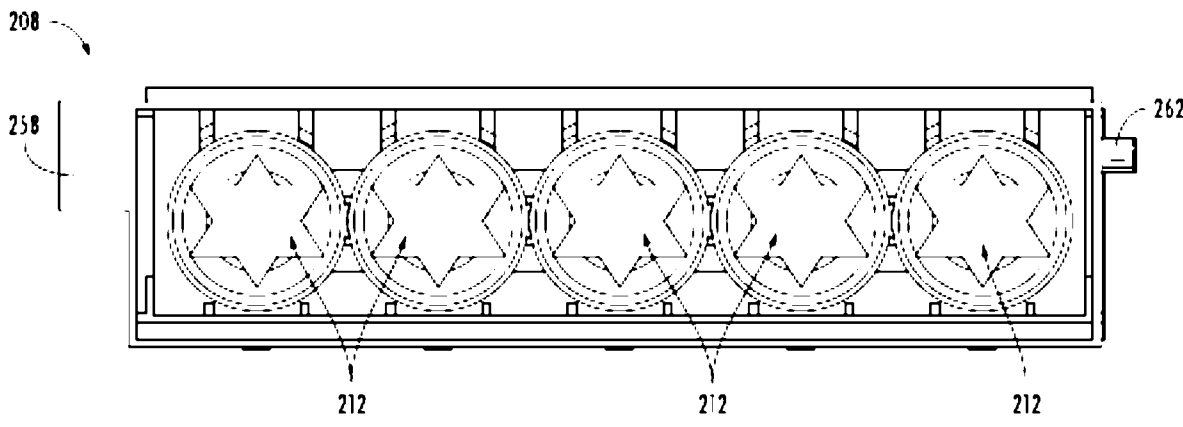


FIG. 13

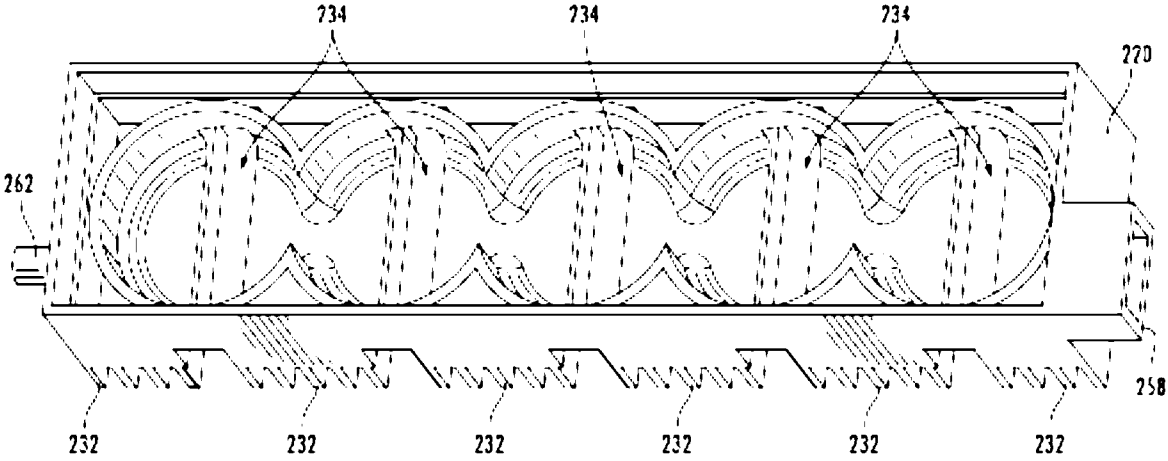


FIG. 14

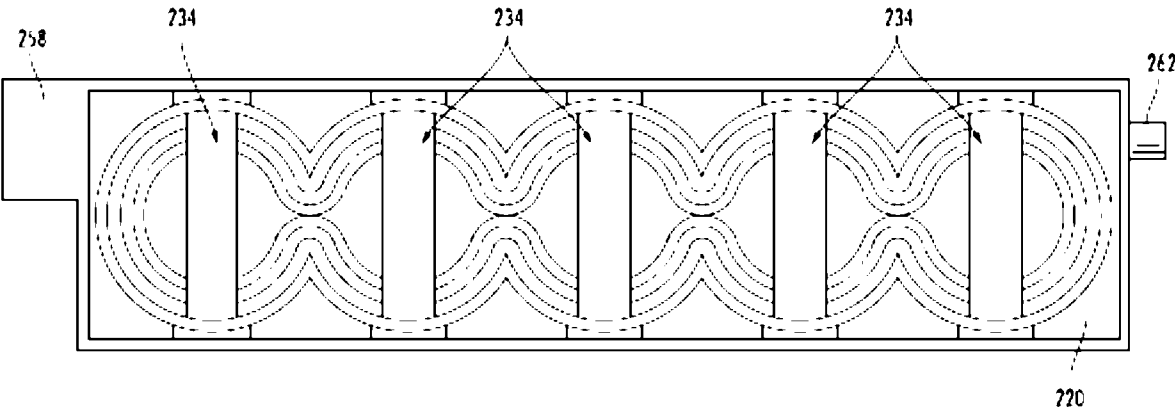


FIG. 15

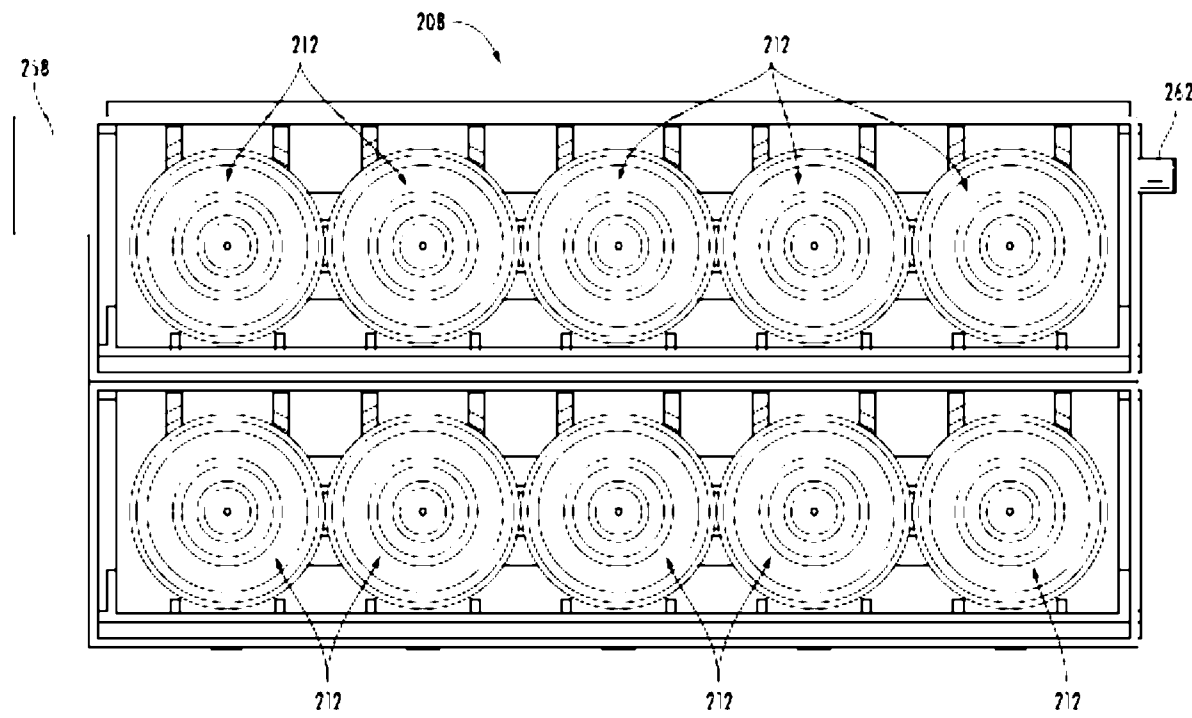


FIG. 16

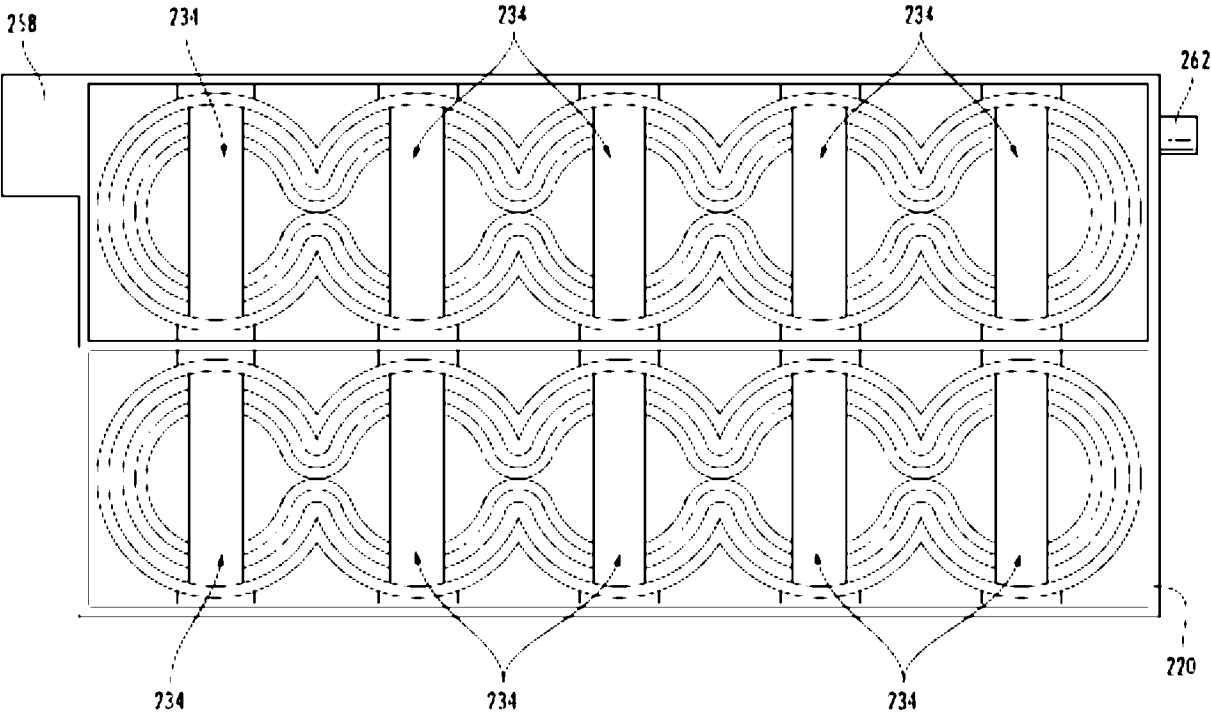


FIG. 17

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/097189

A. CLASSIFICATION OF SUBJECT MATTER F25C1/10(2006.01)i; F25C5/06(2006.01)i; F25D23/12(2006.01)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) IPC:F25C; 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) CNTXT,ENTXT,DWPL,WPABS,CJFD:HAIER, ice, tray, refrigerat+, cool+, mold, rotat+, frame, pivot, joint, cross, beam+, bar, resilien+, flex+, elastic+, deform+, transform+, removal, detach+		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2020158403 A1 (LG ELECTRONICS INC.) 21 May 2020 (2020-05-21) description paragraphs 0057-0070,figures 4-32	1-4,6-13,15-18
Y	US 2020158403 A1 (LG ELECTRONICS INC.) 21 May 2020 (2020-05-21) description paragraphs 0057-0070,figures 4-32	5,14
Y	US 2006086107 A1 (VOGLEWEDE R. L. et al.) 27 April 2006 (2006-04-27) description paragraphs 0030-0044,figures 3-7	5-14
A	US 2022146176 A1 (ELECTROLUX HOME PROD INC.) 12 May 2022 (2022-05-12) the whole document	1-18
A	US 2014260406 A1 (WHIRLPOOL CORP.) 18 September 2014 (2014-09-18) the whole document	1-18
A	US 2019271496 A1 (WHIRLPOOL CORP.) 05 September 2019 (2019-09-05) the whole document	1-18
A	JP 2005326035 A (JAPAN SERVO CO., LTD.) 24 November 2005 (2005-11-24) the whole document	1-18
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “D” document cited by the applicant in the international application “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&” document member of the same patent family		
Date of the actual completion of the international search 04 September 2024		Date of mailing of the international search report 10 September 2024
Name and mailing address of the ISA/CN CHINA NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China		Authorized officer SUN,Ying Telephone No. (+86) 010-53962876

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/097189

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item 1.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing:
 - a. ☐ forming part of the international application as filed.
 - b. ☒ furnished subsequent to the international filing date for the purposes of international search (Rule 13ter.1(a)),
☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the international application as filed.
2. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this report has been established to the extent that a meaningful search could be carried out without a WIPO Standard ST.26 compliant sequence listing.
3. Additional comments:

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2024/097189

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2020158403	A1	21 May 2020	KR	20200057600	A	26 May 2020
				US	2024151450	A1	09 May 2024
				US	2024151449	A1	09 May 2024
				US	11874045	B2	16 January 2024
				KR	20230136583	A	26 September 2023
				EP	3653958	A1	20 May 2020
				US	2020158413	A1	21 May 2020
				WO	2020101409	A1	22 May 2020
				KR	20200112548	A	05 October 2020
				KR	20210005485	A	14 January 2021
US	2006086107	A1	27 April 2006	US	7131280	B2	07 November 2006
				PL	1653171	T3	29 July 2016
				EP	1653171	A2	03 May 2006
				EP	1653171	B1	16 March 2016
				AU	2005225162	A1	11 May 2006
				AU	2005225162	B2	27 May 2010
US	2022146176	A1	12 May 2022	US	11874046	B2	16 January 2024
US	2014260406	A1	18 September 2014	US	9170042	B2	27 October 2015
US	2019271496	A1	05 September 2019	US	10551107	B2	04 February 2020
JP	2005326035	A	24 November 2005	JP	4657626	B2	23 March 2011