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• **Haier US Appliance Solutions, Inc.**
Wilmington, DE 19801 (US)

(72) Inventors:
• **PERURI, Venkataramana**
Wilmington, Delaware 19801 (US)
• **KOPPINENI, Rambabu**
Wilmington, Delaware 19801 (US)
• **SHAH, Mark Dilip**
Wilmington, Delaware 19801 (US)
• **PFAFFINGER, Robert Charles**
Wilmington, Delaware 19801 (US)

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(71) Applicants:
• **Qingdao Haier Refrigerator Co., Ltd**
Qingdao, Shandong 266101 (CN)
• **Haier Smart Home Co., Ltd.**
Qingdao, Shandong 266101 (CN)

(74) Representative: **Gille Hrabal**
Partnerschaftsgesellschaft mbB
Patentanwlte
Brucknerstrae 20
40593 Dsseldorf (DE)

(54) **ICE DISCHARGE ELECTRIC MOTOR ASSEMBLY HAVING INDEPENDENT HOUSING WITH MINIMIZED INTERNAL VOLUME**

(57) An ice dispensing motor assembly includes a motor in operative communication with an auger of an ice maker. The motor is enclosed within a first housing.

The motor assembly also includes a driver circuit in electrical communication with the motor. The driver circuit is enclosed within a second housing.

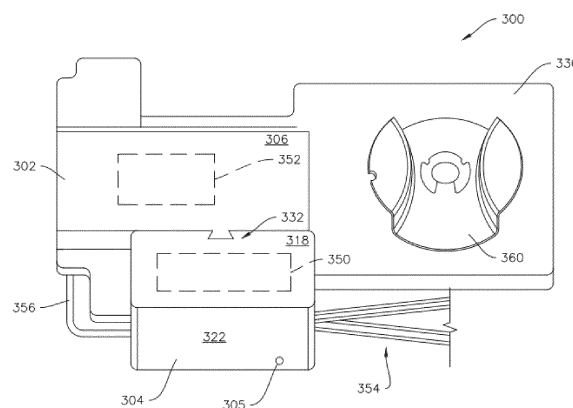


FIG. 8

Description

FIELD OF THE INVENTION

[0001] The present subject matter relates generally to ice maker dispensing systems, and in particular to motor assemblies for dispensing systems.

BACKGROUND OF THE INVENTION

[0002] Certain refrigerator appliances include an ice maker. An ice maker may also be a stand-alone appliance designed for use in commercial and/or residential kitchens. To produce ice, liquid water is directed to the ice maker and frozen. For example, certain ice makers include a mold body for receiving liquid water. After ice is formed in the mold body, it may be stored within an ice bin or bucket within the refrigerator appliance. In order to maintain the ice in a frozen state, the ice bin is positioned within a chilled chamber of the refrigerator appliance or a separate compartment behind one of the doors. In some appliances, a dispenser is provided in communication with the ice bin to automatically dispense a selected or desired amount of ice to a user (e.g., through a door of the refrigerator appliance). Typically, a rotating auger is provided within the ice bin to help move ice from the ice bin to the dispenser.

[0003] In order to move, e.g., rotate, the auger within the bin, a motor is provided outside of the bin. The motor is part of a motor assembly which is typically housed within a single enclosure that contains multiple components, e.g., both the motor and a driver circuit connected thereto.

[0004] However, such motor assemblies with a single enclosure create certain disadvantages. For example, the entire enclosure must provide sufficient sealing and resilience to meet applicable standards for the motor when reactive refrigerants, e.g., flammable or explosive refrigerants, are used.

[0005] Accordingly, a motor assembly for an ice maker with features for improved mounting and isolation of the components of the motor assembly would be useful.

BRIEF DESCRIPTION OF THE INVENTION

[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] In a first exemplary embodiment, an ice maker is provided. The ice maker includes a mold for forming ice therein and an ice bin. The ice bin has a bin body defining a storage volume to receive ice formed in the mold within the storage volume. The ice maker also includes an auger extending within the storage volume and a motor assembly. The motor assembly includes a motor in operative communication with the auger. The motor is enclosed within a first housing. The motor assembly also

includes a driver circuit in electrical communication with the motor. The driver circuit is enclosed within a second housing.

[0008] In a second exemplary embodiment, a motor assembly for an ice maker is provided. The motor assembly includes a motor in operative communication with an auger of the ice maker. The motor is enclosed within a first housing. The motor assembly also includes a driver circuit in electrical communication with the motor. The driver circuit is enclosed within a second housing.

[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.

FIG. 1 provides a perspective view of a refrigerator appliance according to one or more exemplary embodiments of the present subject matter.

FIG. 2 provides an interior perspective view of a dispenser door of the exemplary refrigerator appliance of FIG. 1.

FIG. 3 provides an interior elevation view of the door of FIG. 2 with an access door of the door shown in an open position.

FIG. 4 provides a cross-sectional side view of an exemplary bin assembly.

FIG. 5 provides a front cross-sectional view of an exemplary bin assembly.

FIG. 6 provides an overhead cross-sectional view of an exemplary bin assembly.

FIG. 7 provides another interior elevation view of a sub-compartment within the door of FIG. 2.

FIG. 8 provides a perspective view of an auger motor assembly according to one or more exemplary embodiments of the present subject matter which may be incorporated into a refrigerator appliance such as the exemplary refrigerator appliance of FIG. 1.

FIG. 9 provides another perspective view of the auger motor assembly of FIG. 8.

FIG. 10 provides another perspective view of the auger motor assembly of FIG. 8.

DETAILED DESCRIPTION

[0011] 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.

[0012] As used herein, terms of approximation such as "generally," "about," or "approximately" 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, e.g., "generally vertical" includes forming an angle of up to ten degrees in any direction, e.g., clockwise or counterclockwise, with the vertical direction V.

[0013] 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 120 that generally defines a vertical direction V, a lateral direction L, and a transverse direction T, which are mutually perpendicular, such that an orthogonal coordinate system is generally defined. The cabinet 120 extends between a top 101 and a bottom 102 along the vertical direction V, between a left side 104 and a right side 106 along the lateral direction L, and between a front 108 and a rear 110 along the transverse direction T. Housing 120 defines chilled chambers for receipt of food items for storage. In particular, housing 120 defines fresh food chamber 122 positioned at or adjacent top 101 of housing 120 and a freezer chamber 124 arranged at or adjacent bottom 102 of housing 120. 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 standalone ice maker 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.

[0014] Refrigerator doors 128 are rotatably hinged to an edge of housing 120 for selectively accessing fresh food chamber 122, e.g., at the left side 104 and the right side 106. 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) mounted within freezer chamber 124 and slidable along the transverse direction T. Refrigerator doors 128 and freezer door 130 are shown in the closed configuration in FIG. 1.

[0015] Refrigerator appliance 100 also includes a dispensing assembly 140 for dispensing liquid water and/or

ice. Dispensing assembly 140 includes a dispenser 142 positioned on or mounted to an exterior portion of refrigerator appliance 100, e.g., on one of doors 128. Dispenser 142 includes a discharging outlet 144 for accessing ice and/or liquid water. An actuating mechanism 146, shown as a paddle, is mounted below discharging outlet 144 for operating dispenser 142. In alternative exemplary embodiments, any suitable actuating mechanism may be used to operate dispenser 142. For example, dispenser 142 can include a sensor (such as an ultrasonic sensor) or a button rather than the paddle. A user interface panel 148 is provided for controlling the mode of operation. For example, user interface panel 148 includes a plurality of user inputs (not labeled), 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.

[0016] Discharging outlet 144 and actuating mechanism 146 are an external part of dispenser 142 and are mounted in a dispenser recess 150. Dispenser recess 150 is positioned at a predetermined elevation convenient for a user to access ice or water and enabling the user to access ice without the need to bend-over and without the need to open doors 128. In the exemplary embodiment, dispenser recess 150 is positioned at a level that approximates the chest level of a user.

[0017] FIG. 2 provides an interior perspective view of a door of refrigerator doors 128. Refrigerator appliance 100 includes a sub-compartment 162 defined on refrigerator door 128. Sub-compartment 162 may be referred to as an "icebox." Sub-compartment 162 extends into fresh food chamber 122 when refrigerator door 128 is in the closed position. As shown in FIG. 3, an ice maker or ice making assembly 160 may be positioned within sub-compartment 162. FIG. 3 illustrates selected components of the ice making assembly 160 according to one or more embodiments, with an ice storage bin assembly 200 (FIGS. 4-6) removed from the sub-compartment 162 to more clearly depict the sub-compartment 162 and other components therein. As will be described in more detail below, ice from the ice maker 160 is collected and stored in an ice storage bin assembly 200 (FIGS. 4-6) and supplied to dispenser recess 150 (FIG. 1) from the ice storage bin assembly 200 in sub-compartment 162 on a back side of refrigerator door 128. Chilled air from a sealed system (not shown) of refrigerator appliance 100 may be directed into components within sub-compartment 162, e.g., ice maker 160 and/or ice storage bin assembly 200. As mentioned above, the present disclosure may also be applied 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 standalone ice maker appliance. Accordingly, the description herein of the icebox 162 on the door 128 of the fresh food chamber 122 is by way of example only. In other example embodiments, the ice maker 160 may be positioned in the freezer chamber 124, e.g., of the illustrated bottom-mount refrigerator, a side by side refrigerator, a top-

mount refrigerator, or any other suitable refrigerator appliance. As another example, the ice maker 160 may also be provided in a standalone icemaker appliance.

[0018] An access door 166 is hinged to the inside of the refrigerator door 128. Access door 166 permits selective access to sub-compartment 162. Any manner of suitable latch 168 is configured with sub-compartment 162 to maintain access door 166 in a closed position. As an example, latch 168 may be actuated by a consumer in order to open access door 166 for providing access into sub-compartment 162. Access door 166 can also assist with insulating sub-compartment 162, e.g., by thermally isolating or insulating sub-compartment 162 from fresh food chamber 122.

[0019] FIG. 3 provides an interior elevation view of refrigerator door 128 with access door 166 shown in an open position. As may be seen in FIG. 3, ice maker 160 is positioned or disposed within sub-compartment 162. Ice maker 160 includes a mold body or casing 170. An ice bucket or ice storage bin 200 (FIG. 4) is positioned proximate the mold body 170 and receives the ice after the ice is ejected from the mold body 170. From ice storage bin 200, the ice can enter dispensing assembly 140 and be accessed by a user as discussed above. In such a manner, ice maker 160 can produce or generate ice. An auger motor 352 (e.g., FIGS. 7-9) may be in mechanical communication with an auger (e.g., auger 252-FIG. 4) of ice storage bin 200.

[0020] Operation of refrigerator appliance 100, including ice maker 160 and dispensing assembly 140 thereof, is controlled by a processing device or controller 190 (FIG. 1), e.g., that may be operatively coupled to control panel 148 for user manipulation to select features and operations of ice maker 160 and dispensing assembly 140. Controller 190 can operate various components of ice maker 160 to execute selected system cycles and features.

[0021] Controller 190 may include a memory and microprocessor, such as a general or special purpose microprocessor operable to execute programming instructions or micro-control code associated with operation of ice maker 160. The memory may represent random access memory such as DRAM, or read only memory such as ROM or FLASH. In one embodiment, the processor executes programming instructions stored in memory. The memory may be a separate component from the processor or may be included onboard within the processor. Alternatively, controller 190 may be constructed without using a microprocessor, e.g., using a combination of discrete analog and/or digital logic circuitry (such as switches, amplifiers, integrators, comparators, flip-flops, AND gates, and the like) to perform control functionality instead of relying upon software. Other components of the ice maker 160 may be in communication with controller 190 via one or more signal lines or shared communication busses.

[0022] Ice maker 160 also includes a temperature sensor 178. Temperature sensor 178 is configured for meas-

uring a temperature of mold body 170 and/or liquids, such as liquid water, within mold body 170. Temperature sensor 178 can be any suitable device for measuring the temperature of mold body 170 and/or liquids therein. For example, temperature sensor 178 may be a thermistor or a thermocouple or a bimetal. Controller 190 can receive a signal, such as a voltage or a current, from temperature sensor 178 that corresponds to the temperature of the mold body 170 and/or liquids therein. In such a manner, the temperature of mold body 170 and/or liquids therein can be monitored and/or recorded with controller 190. Some embodiments can also include an electromechanical icemaker configured with a bimetal to complete an electrical circuit when a specific temperature is reached.

[0023] Turning now generally to FIGS. 4 through 6, various views are provided of an ice storage bin assembly 200 according to exemplary embodiments of the present disclosure. Storage bin assembly 200 may be used within and selectively attached to a cabinet 102 of a refrigerator appliance 100 (FIG. 2), e.g., within the icebox (sub-compartment) 162 thereof. In exemplary embodiments, storage bin assembly 200 is removably positioned within the sub-compartment 162 below the mold body 170 to receive ice cubes from the mold body 170 of the ice maker 160 (FIG. 3).

[0024] As described herein, it is understood that the vertical direction V, lateral direction L, and transverse direction T described within the context of FIGS. 4 through 6 generally correspond to storage bin assembly 200 in isolation. However, these directions may also align with (e.g. be parallel to) the respective vertical direction V, lateral direction L, and transverse direction T defined by refrigerator appliance 100 (FIG. 1) when storage bin assembly 200 is attached to cabinet 102 or mounted to a door 128 (FIG. 1) in the closed position.

[0025] Storage bin assembly 200 generally includes a bin body 210 extending along the vertical direction V from a bottom end 212 to a top end 214. Bin body 210 may generally be formed as a solid, nonpermeable structure having one or more sidewalls 220 defining a storage volume 222 to receive ice therein (e.g., from ice making assembly 160-FIG. 3).

[0026] In certain embodiments, sidewalls 220 include a front wall 216 and a rear wall 218. When bin body 210 is positioned or mounted within sub-compartment 162 (FIG. 3), front wall 216 may generally be positioned forward from rear wall 218. Specifically, rear wall 218 may be positioned proximal to door 128 while front wall 216 is positioned proximal to fresh food compartment 122 (e.g., along the transverse direction T as would be defined when the corresponding door 128 is in the closed position). Optionally, a handle 230 may be provided on front wall 216. For instance, handle 230 may be formed on front wall 216 such that a user grip is defined at a front end of bin body 210. Additionally or alternatively, a suitable handle structure may be mounted to another portion of storage bin assembly 200.

[0027] In additional or alternative embodiments, one portion of bin body 210 may be formed from a transparent material, such as a suitable rigid polymer (e.g., acrylic, polycarbonate, etc.), through which a user may view the contents of storage volume 222. For instance, front wall 216 may be a transparent wall formed from the transparent material. Optionally, each sidewall 220 may be a transparent wall formed from the transparent material. Additionally or alternatively, each wall (e.g., 220 and 228) may be integrally-formed with the other walls (e.g., such that bin body 210 is provided as a unitary monolithic member).

[0028] At top end 214, bin body 210 generally defines a bin opening 224 (see, e.g., FIG. 6) through which ice may pass into storage volume 222. Below top end 214 (e.g., at a bottom end 212), bin body 210 may define a dispenser opening 226 through which ice may pass from storage volume 222 (e.g., to dispensing assembly 140-FIG. 1). For example, bin body 210 may include a bottom wall 228 (e.g., attached to or integral with sidewalls 220) that defines dispenser opening 226 in communication with storage volume 222, e.g., whereby ice from the storage volume 222 may travel from the storage volume 222 to and through the dispenser opening 226 and from the dispenser opening 226 to discharging outlet 144 (FIG. 1).

[0029] Optionally, dispenser opening 226 may be defined as a vertical opening (e.g., parallel to the vertical direction V through bottom wall 228). Thus, dispenser opening 226 may define a horizontal perimeter 232. A perimeter wall 234 may extend vertically about dispenser opening 226 (e.g., from bottom wall 228) and horizontal perimeter 232. Additionally or alternatively, perimeter wall 234 may define at least a portion of horizontal perimeter 232.

[0030] Generally, horizontal perimeter 232 defines the horizontal extrema of dispenser opening 226 (e.g., perpendicular to the vertical direction V). In some embodiments, at least two horizontal extrema for the horizontal perimeter 232 are provided as a front edge 236 and a rear edge 238. Generally, front edge 236 is positioned forward from rear edge 238 and rear edge 238 is positioned rearward from front edge 236 (e.g., along or relative to the transverse direction T). Front edge 236 may be defined proximal to front wall 216 and rear edge 238 may be defined proximal to the rear wall 218 (e.g., along the transverse direction T). Additionally or alternatively, dispenser opening 226 may be defined closer to rear wall 218 than front wall 216 (i.e., proximal to rear wall 218 or distal to front wall 216). For instance, the longitudinal distance (e.g., along the transverse direction T) between front edge 236 and front wall 216 may be greater than the longitudinal distance between rear edge 238 and rear wall 218.

[0031] In some embodiments, the entirety of top end 214 is open and unobstructed. Top end 214 and bin opening 224 may be free of any lid or enclosing portion. Optionally, bin opening 224 may define a radial or horizontal maximum of storage volume 222 (i.e., the maximum ra-

dial or horizontal width of storage volume 222). Advantageously, bin opening 224 may provide easy and direct access to storage volume 222 through which ice may pass. A user may thus easily scoop or pour large amounts of ice from storage volume 222 directly through bin opening 224.

[0032] In certain embodiments, an auger 252 is provided or mounted (e.g., rotatably mounted) within storage volume 222 to selectively direct ice within the storage volume 222 to the dispenser opening 226. Optionally, auger 252 is positioned above bottom wall 228 or dispenser opening 226.

[0033] As shown, exemplary embodiments of auger 252 include a rotation shaft 254 that extends along a rotation axis X (e.g., perpendicular to the vertical direction V). In the illustrated exemplary embodiments, rotation shaft 254 extends through a sidewall 220 (e.g., rear wall 218) and through at least a portion of storage volume 222. During use, auger 252 and rotation shaft 254 can thus selectively rotate within storage volume 222 (e.g., relative to bin body 210).

[0034] In certain embodiments, rotation shaft 254 selectively engages auger motor 352 (FIGS. 3 and 8-10). For instance, in exemplary embodiments, an adapter key 256 is connected or attached to rotation shaft 254. For instance, a portion of rotation shaft 254 may extend through bin body 210 and support adapter key 256 outside of storage volume 222. In some such embodiments, adapter key 256 is fixed to rotation shaft 254 and rotatable about rotation axis X. When storage bin assembly 200 is attached to refrigerator appliance 100 (e.g., mounted to a door 128-FIG. 3), adapter key 256 may engage auger motor 352 in a horizontal connection beside bin body 210. In particular embodiments, as described in more detail below, the adapter key 256 may engage a driver 360 coupled to the motor 352 such that the adapter key 256 is engaged with the auger motor 352 via the driver 360. Adapter key 256 may thus establish mechanical communication between auger motor 352 and auger 252. During use, auger motor 352 may motivate rotation of adapter key 256 and rotation shaft 254 about the rotation axis X.

[0035] In some embodiments, the horizontal connection between auger motor 352 and rotation shaft 254 permits storage bin assembly 200 to slide horizontally (i.e., perpendicular to the vertical direction V) into attachment with refrigerator appliance 100 (FIG. 3) without requiring any vertical movement or motion of storage bin assembly 200. Advantageously, a user may attach or remove storage bin assembly 200 from refrigerator appliance 100 without lifting storage bin assembly 200.

[0036] An auger blade 258 may be coiled about rotation shaft 254 and, thus, generally about the rotation axis X. Specifically, auger blade 258 extends radially outward from or relative to rotation shaft 254. As shown, auger blade 258 defines a blade radius R. Blade radius R may define an outer radius or width of auger 252 relative to a radial direction perpendicular to the rotation axis X.

[0037] Generally, auger blade 258 extends along (e.g., relative to) the rotation axis X from a first blade end 260 to a second blade end 262. First blade end 260 may define one axial extreme of auger blade 258 while second blade end 262 defines an opposite axial extreme. Optionally, the longitudinal or axial length of auger blade 258 may be less than the longitudinal or axial length of rotation shaft 254. Thus, auger blade 258 may extend only upon a sub-portion of the rotation shaft 254 that is less than the whole of rotation shaft 254 (e.g., the whole portion of rotation shaft 254 that is positioned within storage volume 222).

[0038] Auger blade 258 may be fixed to rotation shaft 254 such that auger blade 258 and rotation shaft 254 rotate in tandem. For instance, auger blade 258 may be fixed from first blade end 260 to second blade end 262. Optionally, auger blade 258 may be formed integrally (e.g., as a unitary monolithic element) with rotation shaft 254.

[0039] From first blade end 260 to second blade end 262, auger blade 258 may be coiled or wound as a helix in a set direction about the rotation axis X. In other words, auger blade 258 may be formed as a right-handed helix (as pictured) or, alternatively, a left-handed helix from first blade end 260 to second blade end 262. The direction of the auger blade 258 winding may generally correspond to the intended direction of ice movement along the rotation axis X (e.g., rearward from second blade end 262 to first blade end 260 or, alternatively, forward from first blade end 260 to second blade end 262) for ice within storage volume 222. In the illustrated exemplary embodiments, the intended direction of movement for ice is rearward and the auger blade 258 is formed as a right-handed helix from first blade end 260 to second blade end 262.

[0040] In some embodiments, first blade end 260 is generally positioned closer to dispenser opening 226 than second blade end 262 (e.g., along or relative to the transverse direction T). In other words, first blade end 260 may be positioned proximal to dispenser opening 226 while second blade end 262 is positioned distal to dispenser opening 226. Rotation of auger 252 may thus generally motivate ice toward the first blade end 260 and toward dispenser opening 226.

[0041] In additional or alternative embodiments, auger blade 258 terminates above (e.g., directly or indirectly over) at least a portion of dispenser opening 226. For instance, as measured along or relative to the rotation axis X, first blade end 260 may be positioned between front edge 236 and rear edge 238 of dispenser opening 226. Specifically, first blade end 260 may be positioned forward from rear edge 238 and rearward from front edge 236 relative to the rotation axis X. As ice is motivated toward dispenser opening 226 (e.g., by rotation of auger 252), the movement of ice that is directly guided or motivated by auger 252 may stop above dispenser opening 226 such that ice is permitted to fall from ice storage volume 222 through dispenser opening 226. Advantageously, ice motivated by auger 252 may be prevented

from being packed or compressed against a sidewall 220 or over dispenser opening 226 (e.g., such that dispenser opening 226 is obstructed by ice clumps).

[0042] As noted above, auger blade 258 defines a blade radius R perpendicular to the rotation axis X. In some embodiments, blade radius R is provided as an expanding radius from first blade end 260 to second blade end 262. Thus, the radial width or blade radius R may increase from first blade end 260 to second blade end 262 (e.g., as would be measured along the rotation axis X). In some such embodiments, the blade radius R defines a frusto-conical profile between first blade end 260 and second blade end 262. In additional or alternative embodiments, a shaft diameter D of rotation shaft 254 (e.g., perpendicular to rotation axis X) does not increase from first blade end 260 to second blade end 262. For instance, shaft diameter D may remain constant (as pictured) or generally decrease along the rotation axis X from first blade end 260 to second blade end 262.

[0043] In exemplary embodiments, the increase of blade radius R (e.g., angle of expansion relative to the rotation axis X) is constant from first blade end 260 to second blade end 262. In alternative embodiments (not shown), the increase of blade radius R is variable from first blade end 260 to second blade end 262.

[0044] As shown, auger blade 258 defines multiple turns between which a blade pitch P is generally defined. In optional embodiments, blade pitch P is variable between first blade end 260 and second blade end 262 (e.g., as would be measured along the rotation axis X). In other words, the longitudinal or axial distance between adjacent turns of auger blade 258 may be different between one (e.g., first) adjacent pair of turns and another (e.g., second) adjacent pair of turns. In exemplary embodiments, the blade pitch P is a variable pitch that decreases from first blade end 260 to second blade end 262. Thus, the variable pitch may increase along the rotation axis X from second blade end 262 to first blade end 260. In some such embodiments, the increase in blade pitch P is constant (i.e., a constant rate of increase relative to longitudinal distance from second blade end 262).

[0045] In additional or alternative embodiments, the increase in blade pitch P from second blade end 262 to first blade end 260 is proportional to the increase in blade radius R from first blade end 260 to second blade end 262. An equal or identical volume may optionally be defined between each pair of adjacent turns of auger blade 258 from first blade end 260 to second blade end 262.

[0046] Advantageously, a set volume of ice may be motivated by auger 252 and may be prevented from being packed or compressed (e.g., before exiting storage volume 222 through dispenser opening 226).

[0047] In certain embodiments, a base platform 264 is provided within storage volume 222. For instance, base platform 264 may be mounted on bottom wall 228 to guide or direct at least a portion of ice within storage volume 222. In some such embodiments, base platform 264 in-

cludes a floor 266 on which ice may be supported within storage volume 222. When assembled, floor 266 may be positioned below rotation shaft 254 or auger blade 258. Additionally or alternatively, a support post 268 may be provided to support auger 252 (e.g., proximal to second blade end 262).

[0048] In additional or alternative embodiments, at least a portion of base platform 264 is matched to the expanding blade radius R of auger blade 258. For instance, floor 266 may decrease in vertical height between the first blade end 260 and the second blade end 262. In some such embodiments, floor 266 defines a complementary shape (e.g., negative profile) to the shape defined by auger blade 258. Notably, base platform 264 may guide ice (e.g., upward) toward auger 252 as the ice is motivated by auger 252 within storage volume 222.

[0049] In optional embodiments, one or more internal bounding walls 272 are provided adjacent to auger 252. For instance, a pair of internal bounding walls 272 may be provided on base platform 264 within storage volume 222. As shown, in exemplary embodiments, the pair of internal bounding walls 272 may be positioned at opposite radial sides of a portion of the auger blade 258 (e.g., at a location between the first blade end 260 and the second blade end 262 along the rotation axis X).

[0050] It is noted that although internal bounding walls 272 are shown as extending on or directly from base platform, additional or alternative embodiments can include one or more bounding walls 272 extending from another portion of storage bin assembly 200. As an example, one or more bounding walls 272 may extend directly from (e.g., attached to or integral with) one or more sidewalls 220. As another example, one or more bounding walls 272 may extend directly from (attached to or integral with) a kick plate 274.

[0051] In some embodiments, the pair of internal bounding walls 272 is positioned forward from first blade end 260 and rearward from second blade end 262. Optionally, the pair of internal bounding walls 272 may extend from an internal surface of opposite sidewalls 220 (e.g., perpendicular to the rotation axis X). Additionally or alternatively, one or both bounding walls 272 may define a complementary shape (e.g., negative profile) to the shape defined by auger blade 258.

[0052] As auger 252 rotates within storage volume 222, the internal bounding walls 272 may block or halt movement of a peripheral ice (e.g., ice outward from the blade radius R) and notably prevent ice from compressing at or adjacent to dispenser opening 226.

[0053] In additional or alternative embodiments, a kick plate 274 is mounted or held within ice storage volume 222 above rotation shaft 254 or auger blade 258. As shown, kick plate 274 is spaced apart from rotation axis X. When assembled, kick plate 274 may extend (e.g., along the transverse direction T or rotation axis X) from a wall end 276 to a free end 278. Optionally, kick plate 274 may extend inward from at least one sidewall 220 (e.g., at wall end 276 from rear wall 218) and halt or terminate

before spanning the entirety of storage volume 222. For instance, a free end 278 of the kick plate 274 may be spaced apart (e.g., along the transverse direction T or rotation axis X) from front wall 216 such that a vertical gap is formed or defined between front wall 216 and kick plate 274.

[0054] In some embodiments, one or more upper bounding walls 280 extend generally along the vertical direction V (e.g., downward) from an underside of kick plate 274. For instance, a pair of upper bounding walls 280 may be positioned at opposite radial sides of a portion of the auger blade 258 (e.g., at a location between the first blade end 260 and the second blade end 262 along the rotation axis X). Additionally or alternatively, the pair of upper bounding walls 280 may be positioned at the free end 278 and further extend rearward therefrom (e.g., toward wall end 276).

[0055] In optional embodiments, at least a portion of kick plate 274 is slanted downward. For instance, the vertical height of kick plate 274 may generally decrease from wall end 276 to free end 278. In some such embodiments, the vertical height may decrease between first blade end 260 and second blade end 262 (e.g., as would be measured along the rotation axis X). In additional or alternative embodiments, free end 278 is located directly above a portion of auger blade 258 between first blade end 260 and second blade end 262. During use, kick plate 274 may generally direct ice downward and away from dispenser opening 226 to a portion of auger 252. Advantageously, kick plate 274 may prevent excessive ice from accumulating within dispenser opening 226. For example, in some embodiments, the kick plate 274 may be hinged within the storage volume 222, e.g., at the free end 278 thereof. The kick plate 274 may pivot about the hinged connection, e.g., the kick plate 274 may drop and rise when the auger 252 rotates. Such movement of the kick plate 274 may advantageously contribute to motivation of ice pieces (nuggets, cubes, etc.) within the storage volume 222 towards the auger 252.

[0056] FIG. 7 provides another, enlarged, elevation view of the interior of the sub-compartment 162. Similar to FIG. 3, the sub-compartment 162 is illustrated in FIG. 7 with the bin assembly 200 removed. FIG. 7 illustrates the relative positions of the mold body 170 of the ice maker 160 (FIG. 3) and an ice dispensing motor assembly 300 (described in more detail below) which houses the auger motor 352 (FIGS. 3 and 8-10). Also as may be seen in FIG. 7, the ice dispensing motor assembly 300 may be received within a wall of the sub-compartment 162.

[0057] FIG. 8 provides a perspective view of an ice dispensing motor assembly 300 as may be incorporated into an ice maker and/or refrigerator appliance, for example, but not limited to, the ice maker 160 and refrigerator appliance 100 described above. The ice dispensing motor assembly 300 may include an auger motor 352 enclosed within a first housing 302 and a driver circuit 350 enclosed within a second housing 304. In some em-

bodiments, the second housing 304 may include a drain hole 305 defined therein. As will be described in more detail, the first housing 302 and the second housing 304 may, in some embodiments, be fully separate and distinct structures which define distinct enclosures for the motor 352 and the driver circuit 350. The motor 352 may be in mechanical communication with an auger of an ice maker, for example, the auger 252 described above, e.g., via a driver 360 which interfaces with the auger 252, as is generally understood by those of ordinary skill in the art, such as via interengagement between the driver 360 and the adapter key 256 (FIGS. 4 and 6). The motor 352 may be coupled to the driver 360 by one or more gears. The driver circuit 350 is a circuit board, such as a printed circuit board (sometimes also referred to as a "PCB"). Components such as the motor, gear(s), and PCB, the structure and function of which are well understood by those of ordinary skill in the art, are not illustrated or described in further detail herein for the sake of brevity and clarity.

[0058] The driver circuit 350 may be in communication with a power supply of the refrigerator, such as electrically coupled to the power supply, via a first set of wires 354. The driver circuit 350 is in communication with the motor 352 via a second wire or set of wires 356. Thus, the driver circuit 350 may supply power to the motor 352. For example, in some embodiments, the driver circuit 350 may be or include a directional relay, e.g., which receives alternating current ("AC") power from the power supply of the refrigerator and provides direct current ("DC") power to the motor 352. In some embodiments, the driver circuit 350 may be or include an AC circuit which receives AC electrical power from the power supply of the refrigerator 100 and the driver circuit 350 may provide DC voltage to the motor 352.

[0059] In some embodiments, the motor 352 may be fully and sealingly enclosed within the first housing 302 and the driver circuit 350 may be fully and sealingly enclosed within the second housing 304. For example, each of the motor 352 and the driver circuit 350 may be fully enclosed on all sides and in all directions by the respective housing 302 or 304. Also by way of example, the penetrations of the wires 354 and 356 through each housing 302 and 304 may be sealed with grommets, such as rubber grommets. The structure and function of grommets are well understood by those of ordinary skill in the art and, as such, are not illustrated or described in further detail herein for brevity and clarity.

[0060] In FIG. 8, the ice dispensing motor assembly 300 is illustrated in a connected position or configuration, with the first housing 302 and the second housing 304 of the ice dispensing motor assembly 300 coupled together. As may be seen in FIG. 8, when the first housing 302 and the second housing 304 are coupled together, the adjacent walls of each housing 302, 304 are snugly fit together, e.g., the adjacent walls of each housing 302 and 304 may be in direct contact with each other and flush with each other over all or approximately all of the

overlapping area between the two adjacent walls. In at least some embodiments, the first housing 302 and the second housing 304 may be coupled together without fasteners. In other embodiments, the first housing 302 and the second housing 304 may be coupled together by one or more male-female joints, e.g., dovetail joints, with mechanical fasteners to supplement the male-female joint(s).

[0061] FIG. 9 illustrates a perspective view of the ice dispensing motor assembly 300 of FIG. 8 in a disconnected configuration, with the first housing 302 and the second housing 304 spaced apart from each other. As can be seen from FIG. 9, the first housing 302 and the second housing 304 are entirely separate and distinct structures. For example, the first housing 302 and second housing 304 are not sub-compartments of a single housing. As may be seen in FIGS. 9 and 10, each of the first housing 302 and the second housing 304 separately and independently defines a complete enclosure for respective components located therein, each independent of the other. For example, each housing 302, 304 includes at least six walls which collectively define such enclosure without any shared walls or other shared, common structures between the two housings 302, 304. As illustrated in FIGS. 9 and 10, the first housing 302 may include a bottom wall 308, a front wall 306, a top wall 310 (FIG. 10), a left wall 312, a right wall 314, and a back wall 316 (FIG. 10). Also as may be seen in FIGS. 9 and 10, the first housing 302 may also include a panel 330 and at least some of the walls may extend through the panel 330 on either side of the panel 330, such as the top wall 310, as well as the left wall 312 and right wall 314. Turning briefly to FIG. 7, the panel 330 of the ice dispensing motor assembly 300 may be generally flush with a wall of the sub-compartment 162. Referring again to FIGS. 9 and 10, the second housing 304 may also include a plurality of walls, e.g., at least six walls, which are wholly separate and distinct from the walls 306, 308, 310, 312, 314, and 316 of the first housing 302. For example, the second housing 304 may include a front wall 318, a top wall 320, a bottom wall 322, a left wall 324, a right wall 326 and a back wall 328. As may be seen in FIGS. 9 and 10, the walls 318, 320, 322, 324, 326, and 328 of the second housing 304 may be continuous and coextensive at each edge and corner defined by an intersection of two or more of the walls 318, 320, 322, 324, 326, and 328, such that the second housing 304 forms a complete enclosure without any common or shared structure between the first housing 302 and the second housing 304.

[0062] As mentioned above, the adjacent walls of each housing 302 and 304 may, in some embodiments, be in direct contact with each other when the first housing 302 and the second housing 304 are coupled together. Thus, referring to FIGS. 8 through 10, when the first housing 302 and the second housing 304 are coupled together, e.g., as illustrated in FIG. 8, the bottom wall 308 (see, e.g., FIG. 9) of the first housing 302 may, in such embodiments, be in direct contact with the top wall 320 (see,

e.g., FIG. 10) of the second housing 304 and the walls 308, 320 may each be flush with the other over all or approximately all of the area of the bottom wall 308 which overlaps with the top wall 320, and vice versa.

[0063] In some embodiments, e.g., as illustrated in FIG. 8, the first housing 302 and the second housing 304 may be coupled together at least in part by at least one male-female joint, such as a box joint or a dovetail joint. In various embodiments, the components of the joint (or joints in some embodiments, such as the examples described below, which include multiple joints) may be snug fit together, or may be press fit, or interference fit. Additionally, in some embodiments, the components of the male-female joint(s) may be bonded together, e.g., with adhesive such as epoxy or glue. Further, in some embodiments, the components of the male-female joint(s) may also or instead be fastened together with one or more mechanical fasteners, such as screws, rivets, bolts, or other mechanical fasteners and combinations thereof. Such mechanical fasteners, e.g., screws, are well understood by those of ordinary skill in the art and, as such, are not specifically illustrated in the accompanying drawings. Thus, in some embodiments, the first housing 302 and the second housing 304 may be coupled together without fasteners, e.g., the male-female joint(s) may be the only connecting and/or securing mechanisms between the first housing 302 and the second housing 304. For example, as illustrated in FIG. 8, the second housing 304 may be coupled to the first housing 302 by a male-female joint, which in the illustrated example embodiments is a dovetail joint 332, and the dovetail joint 332 may include a male dovetail 334 (FIG. 9) and a female dovetail 336 (FIG. 9). Moreover, in alternative embodiments, the first housing 302 and the second housing 304 may be coupled together with fasteners, e.g., in addition to or instead of the male-female joint.

[0064] Turning now to FIG. 10, in some embodiments, the dovetail joint 332 may be a first dovetail joint, and the first housing 302 and the second housing 304 may, in such embodiments, also be coupled by a second dovetail joint comprising a second male dovetail 338 and a second female dovetail 340 (or, in additional embodiments, the first and second joints may be another type of male-female joints, such as box joints, tab and slot joints, or mortise and tenon joints). As may be seen in FIGS. 8 through 10 generally, first dovetail joint 332 may be on a first side of the first housing 302 and the second housing 304 and the second dovetail joint may be on a second side of the first housing 302 and the second housing 304 which is opposite the first side. For example, the first male dovetail 334 and the first female dovetail 336 may, in some embodiments, be located on the front walls 306 and 318 (either respectively as in the illustrated example embodiments, or the relative positions of the first male dovetail 334 and the first female dovetail 336 on the first housing 302 and the second housing 304 may be reversed) while the second male dovetail 338 and the second female dovetail 340 may, in such embodiments, be

located on the back wall 328 of the second housing 304 and the back wall 316 of the first housing 302 (as with the first dovetails, the second male dovetail 338 and the second female dovetail 340 may be located on the second housing 304 and the first housing 302, respectively, as in the illustrated example embodiments, or the relative positions of the second male dovetail 238 and the second female dovetail 340 on the first housing 302 and the second housing 304 may be reversed). Thus, where the front wall 306 of the first housing 302 is opposite the back wall 316 of the first housing 302 and the front wall 318 of the second housing 304 is opposite the back wall 328 of the second housing 304, the first dovetail joint 332 may be opposite the second dovetail joint.

[0065] As best seen in FIG. 10, in some embodiments, the ice dispensing motor assembly 300 may also include a third male-female joint, e.g., a third dovetail joint. The third dovetail joint may include a third male dovetail 342 and a third female dovetail 344, e.g., as illustrated in FIG. 10. The third male dovetail 342 and the third female dovetail 344 may, in some embodiments, be positioned on the same side of the auger motor assembly 300 as, e.g., may be co-planar with, the second male dovetail 338 and the second female dovetail 340.

[0066] The ice dispensing motor assembly 300 as disclosed herein may provide numerous advantages. For example, by virtue of the separate housings 302 and 304, the internal volume of the auger motor assembly may be minimized or reduced, e.g., as compared to a single housing or sub-compartments, e.g., divided by one or more partitions, within a single housing. In particular, in appliances where reactive, e.g., flammable or explosive, refrigerant is used, the minimized or reduced internal volume may reduce the available oxygen to fuel such reactions.

[0067] 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 and dispensing system, comprising:
 - a mold for forming ice therein;
 - an ice bin comprising a bin body defining a storage volume to receive ice formed in the mold therein;

- an auger extending within the storage volume;
and
an ice dispensing motor assembly, the ice dispensing motor assembly comprising:
- an auger motor in operative communication with the auger, the auger motor enclosed within a first housing; and
a driver circuit in electrical communication with the auger motor, the driver circuit enclosed within a second housing.
2. The system of claim 1, wherein the second housing of the ice dispensing motor assembly is separate and distinct from the first housing of the ice dispensing motor assembly.
 3. The system of claim 1, wherein the second housing of the ice dispensing motor assembly is coupled to the first housing of the ice dispensing motor assembly.
 4. The system of claim 3, wherein the second housing of the ice dispensing motor assembly is coupled to the first housing of the ice dispensing motor assembly by a dovetail joint.
 5. The system of claim 3, wherein the second housing of the ice dispensing motor assembly is coupled to the first housing of the ice dispensing motor assembly by a first dovetail joint on a first side of the first housing and a second dovetail joint on a second side of the first housing opposite the first side of the first housing.
 6. The system of claim 3, wherein the second housing of the ice dispensing motor assembly is coupled to the first housing of the ice dispensing motor assembly with or without fasteners.
 7. The system of claim 1, wherein a wall of the second housing of the ice dispensing motor assembly is in contact with a wall of the first housing of the ice dispensing motor assembly.
 8. The system of claim 1, wherein the driver circuit is fully enclosed within the second housing of the ice dispensing motor assembly.
 9. An ice dispensing motor assembly, the motor assembly comprising:

a motor configured for operative communication with an auger of an ice maker, the motor enclosed within a first housing; and
a driver circuit in electrical communication with the auger motor, the driver circuit enclosed within a second housing.
 10. The ice dispensing motor assembly of claim 9, wherein the second housing is separate and distinct from the first housing.
 11. The ice dispensing motor assembly of claim 9, wherein the second housing is coupled to the first housing.
 12. The ice dispensing motor assembly of claim 11, wherein the second housing is coupled to the first housing by dovetail joints.
 13. The ice dispensing motor assembly of claim 11, wherein the second housing is coupled to the first housing by a first dovetail joint on a first side of the first housing and a second dovetail joint on a second side of the first housing opposite the first side of the first housing.
 14. The ice dispensing motor assembly of claim 11, wherein the second housing is coupled to the first housing with or without fasteners.
 15. The ice dispensing motor assembly of claim 9, wherein a wall of the second housing is in contact with a wall of the first housing.
 16. The ice dispensing motor assembly of claim 9, wherein the driver circuit is fully enclosed within the second housing.

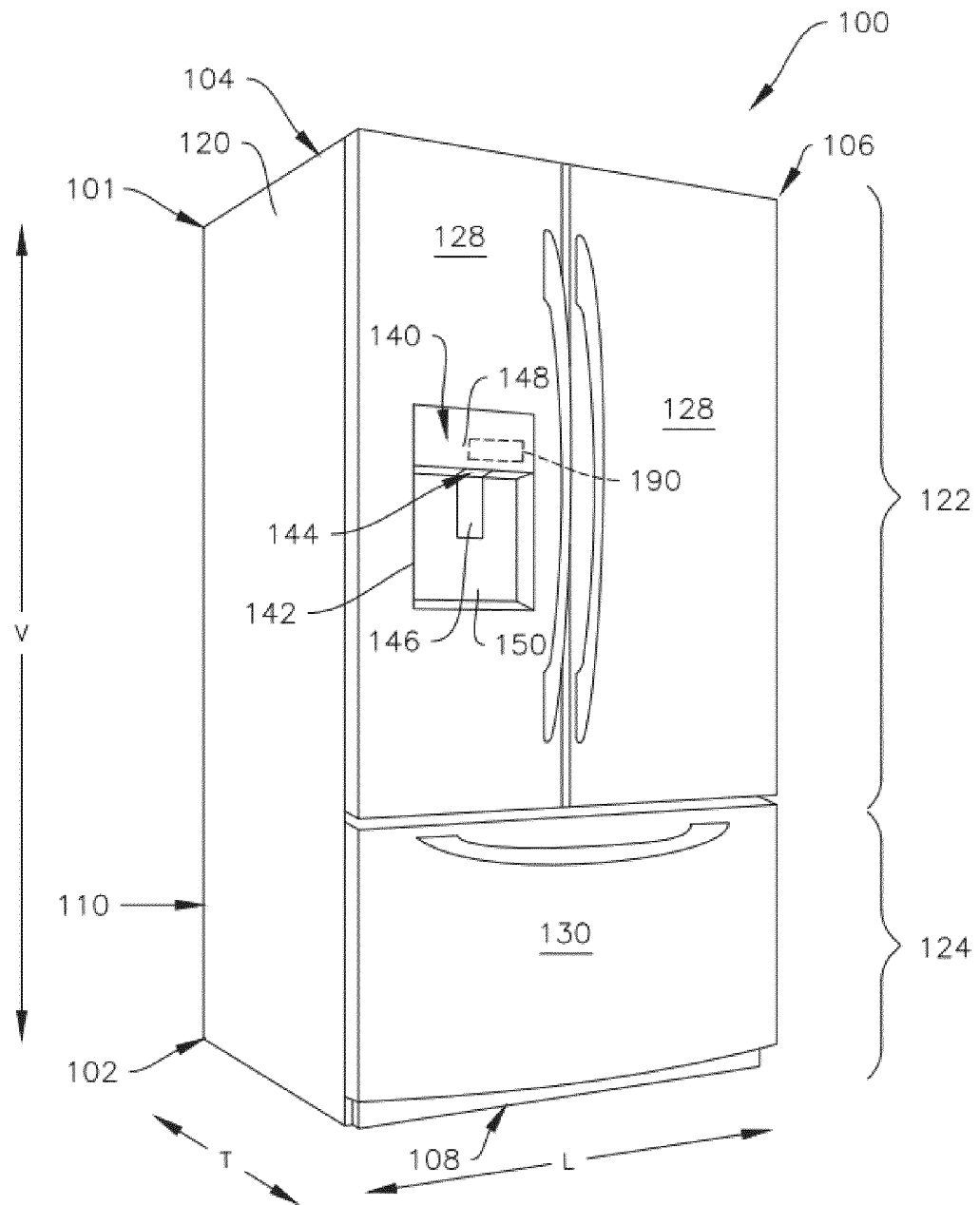


FIG.1

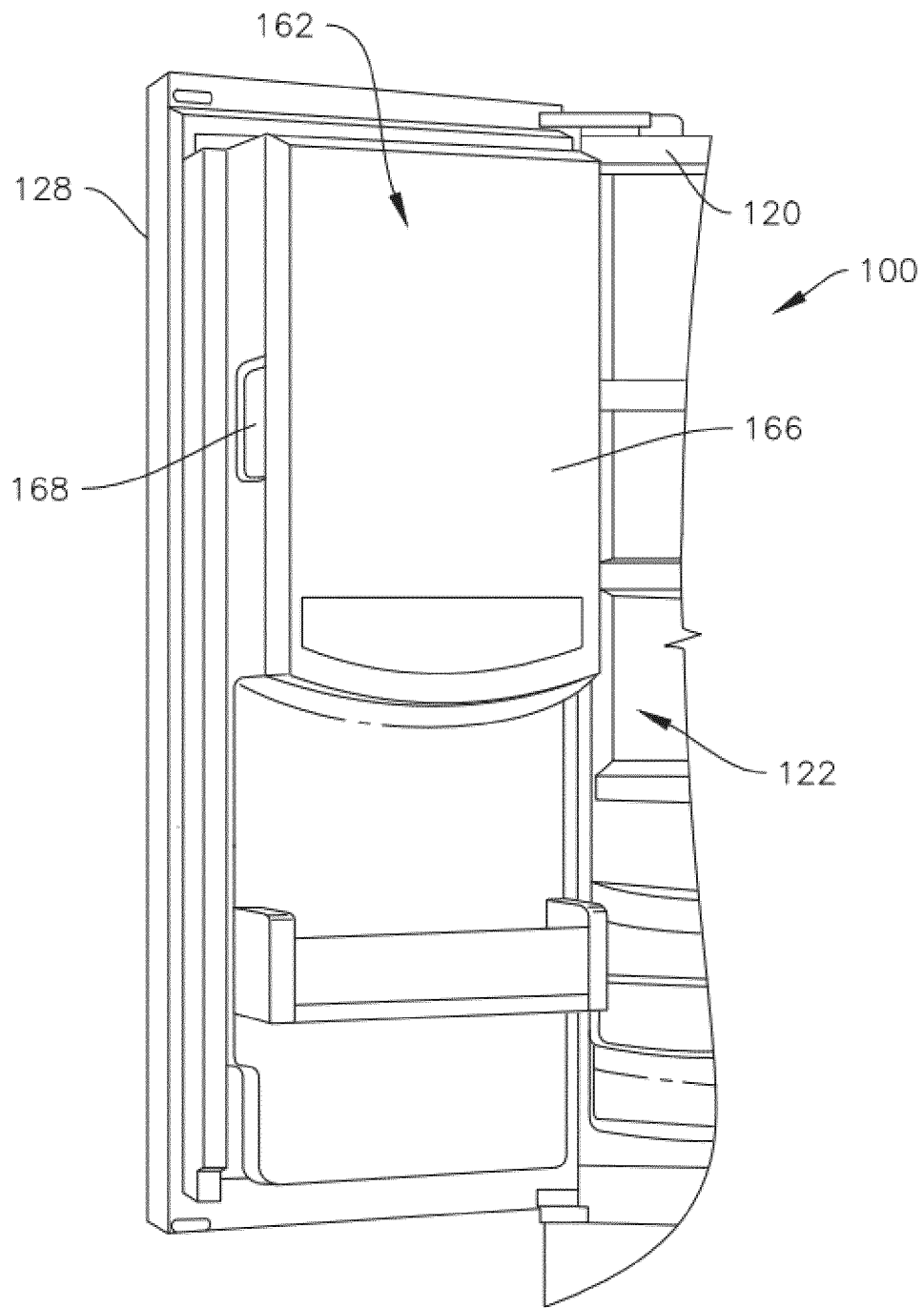


FIG.2

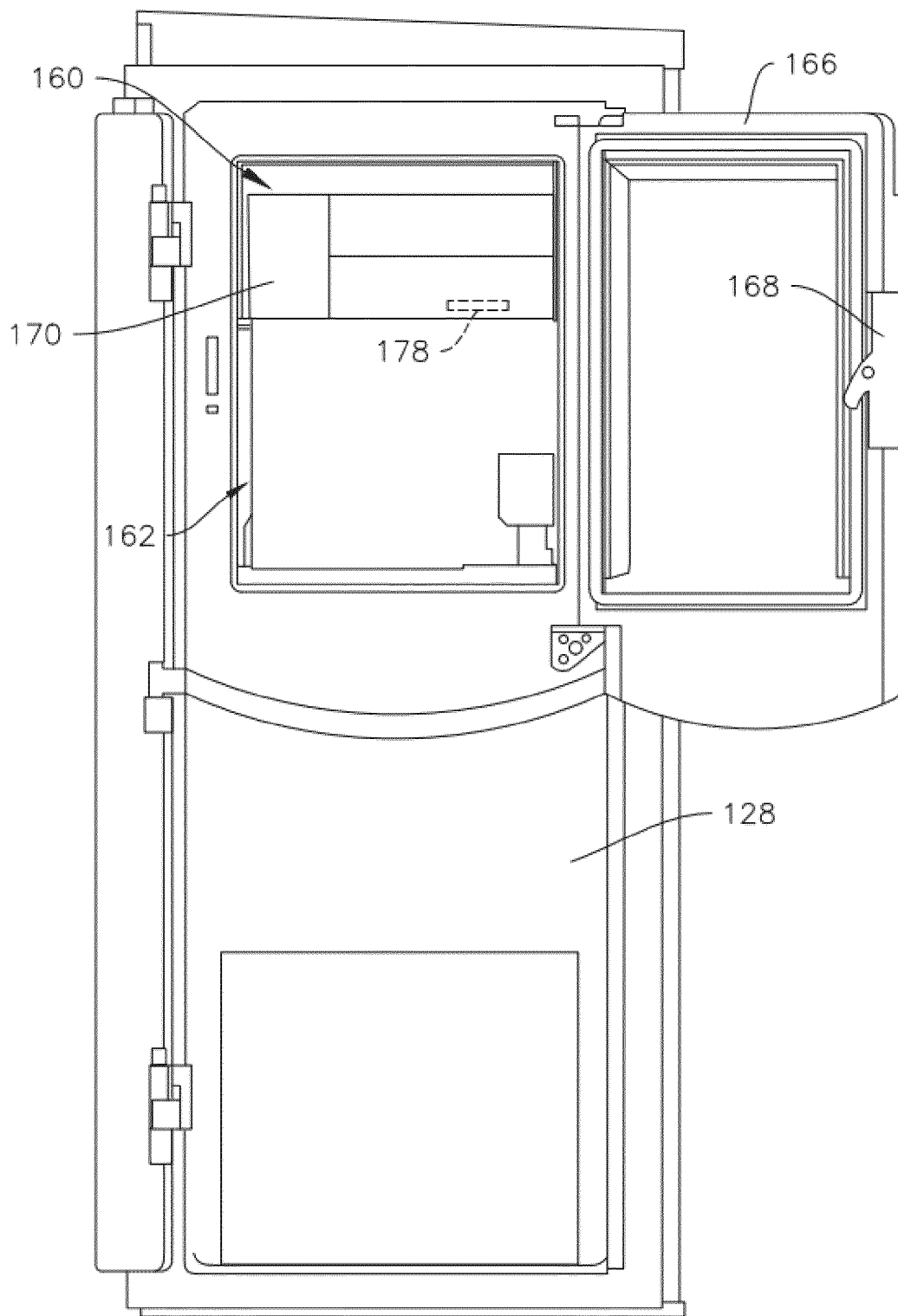


FIG.3

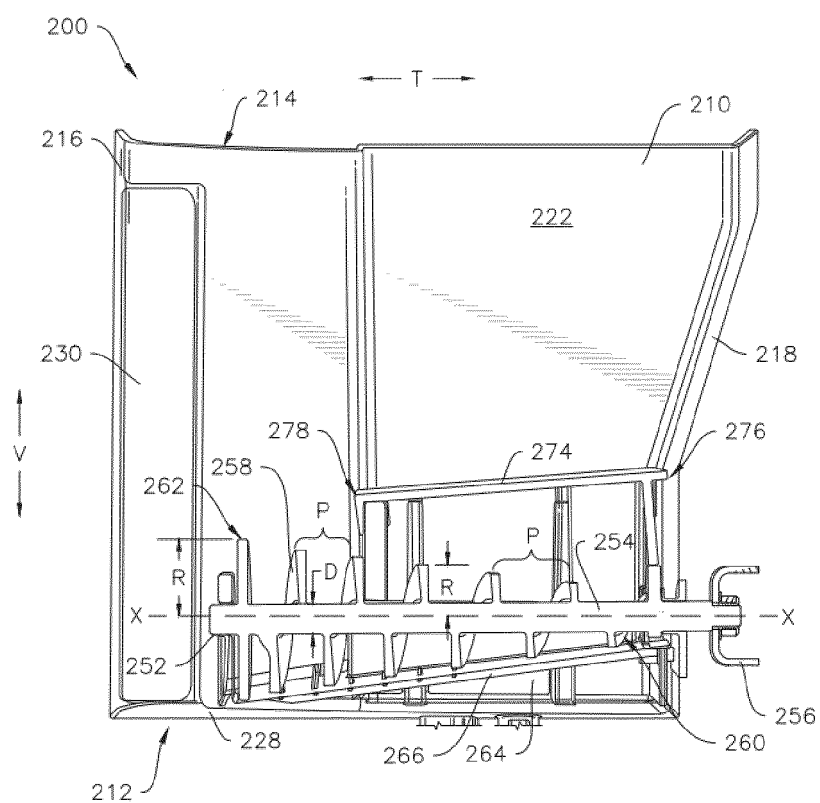


FIG.4

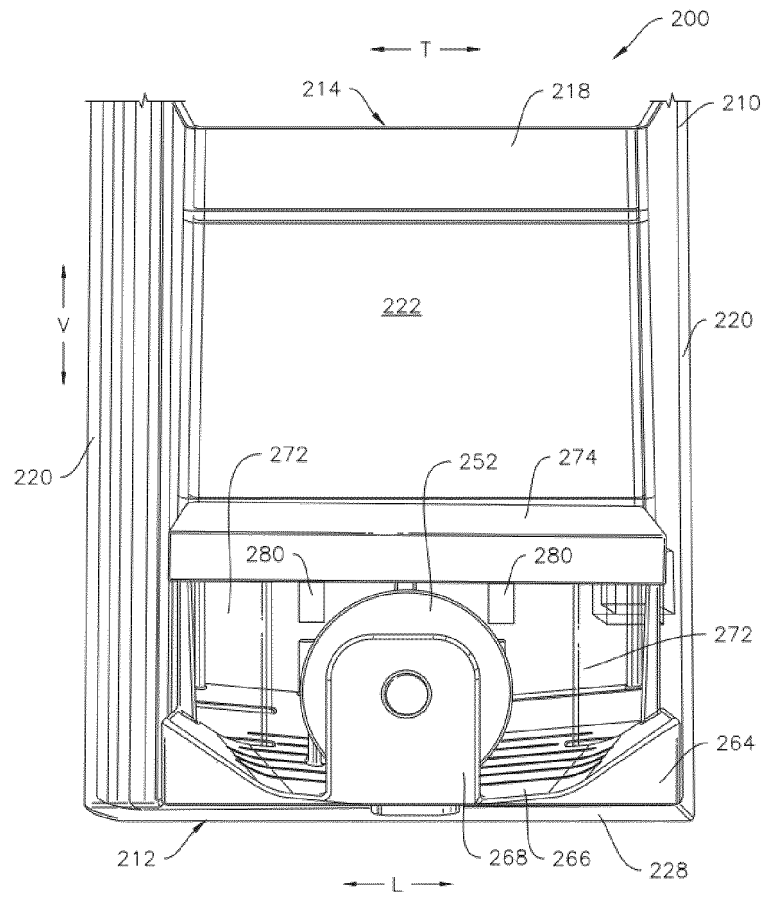


FIG. 5

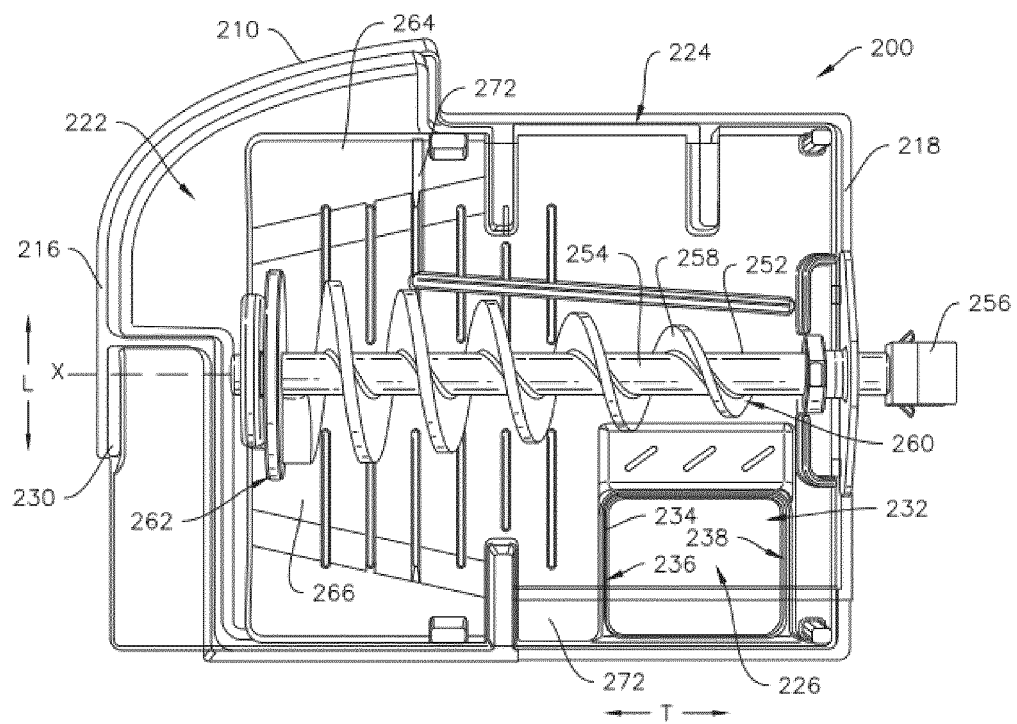


FIG. 6

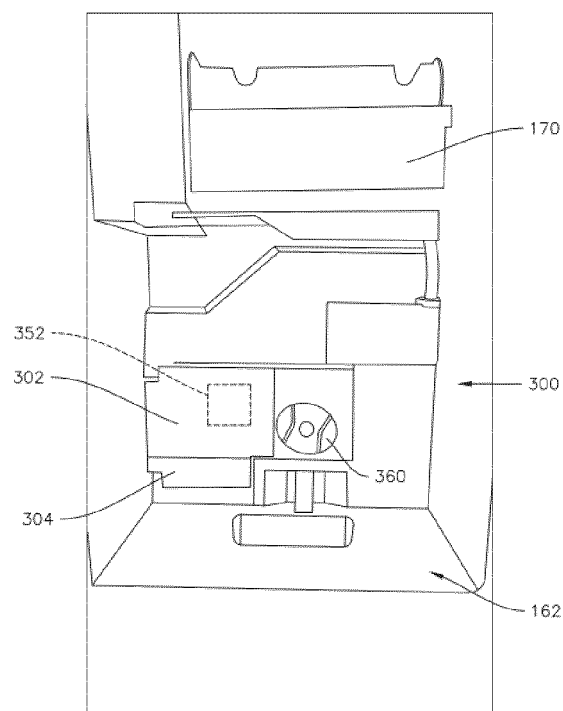


FIG. 7

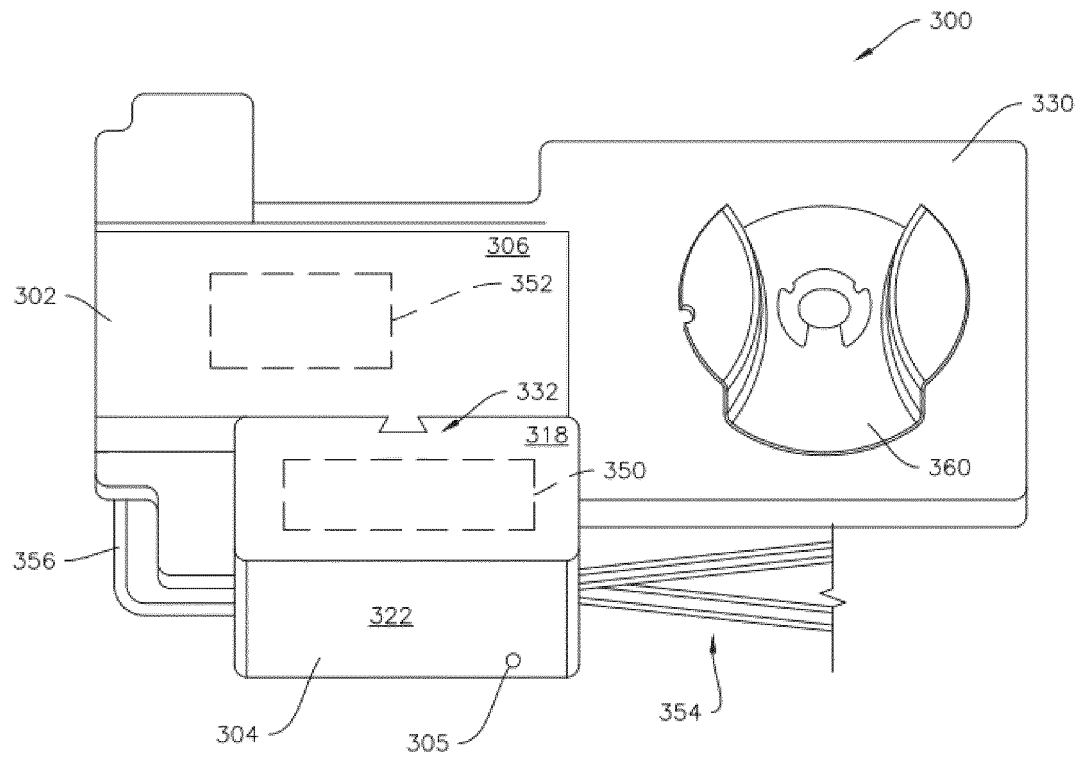


FIG. 8

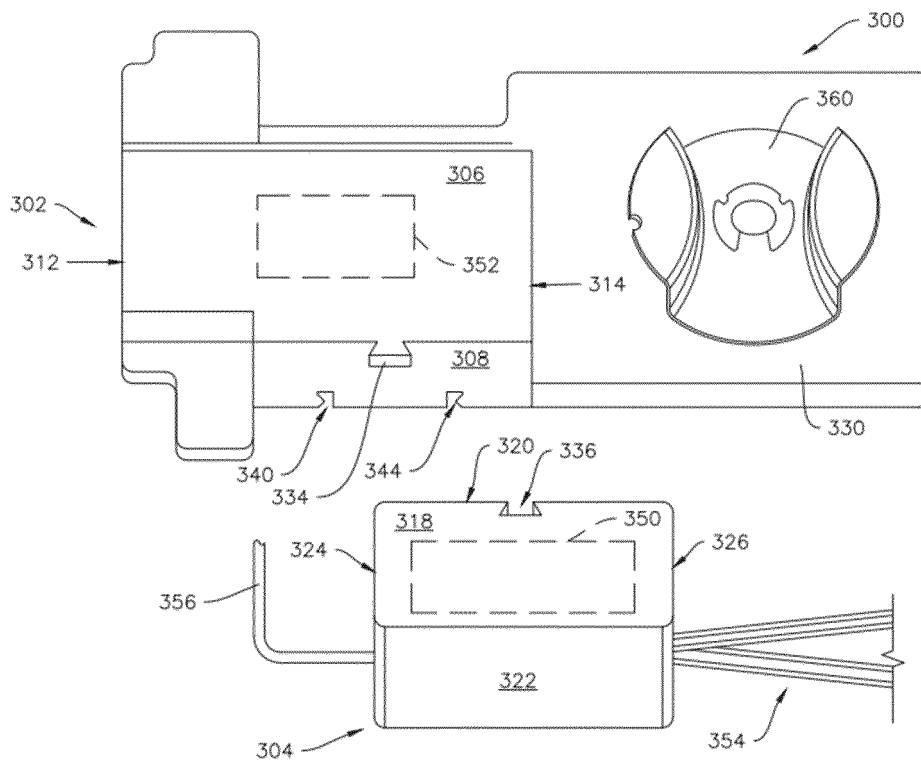


FIG. 9

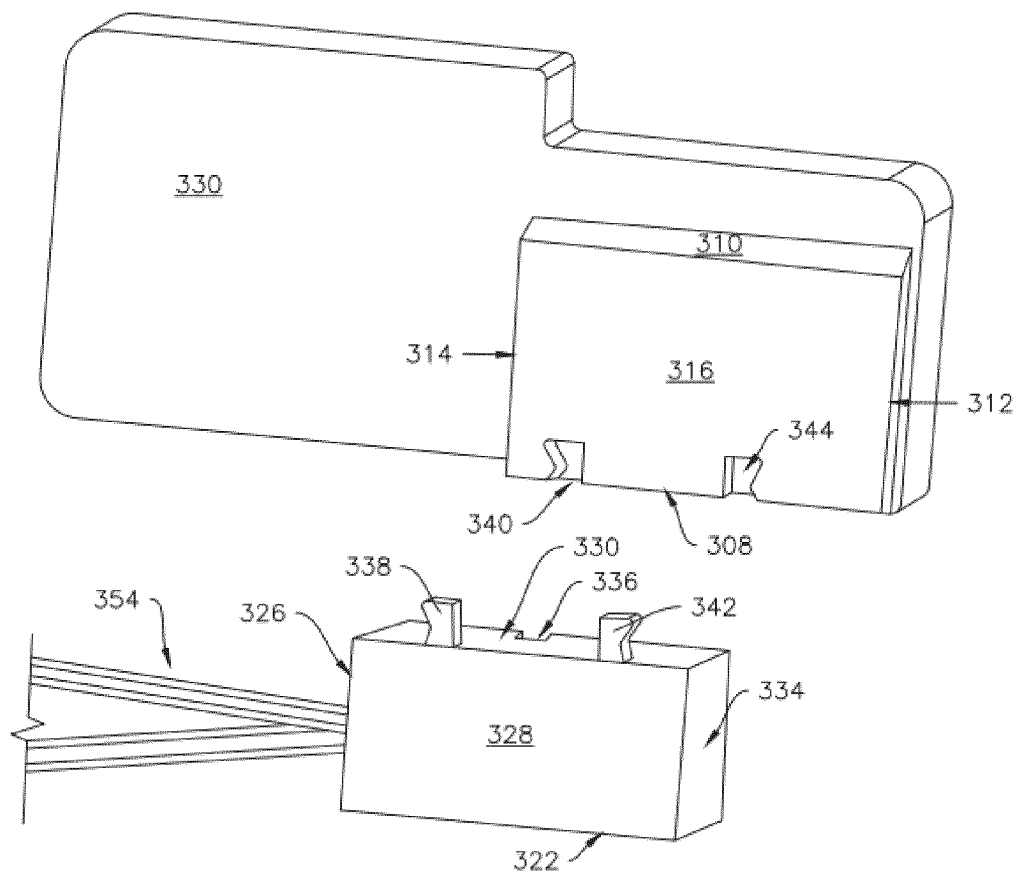


FIG.10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/120997

A. CLASSIFICATION OF SUBJECT MATTER F25C 5/02(2006.01)i; F25D 29/00(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) F25C5/02; F25C5/00; F25D29/00; F25D23/10; F25FD23/00; F25D11/00; F25D13/00; F25C1/00 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) CNABS, CNTXT, CNKI, VEN: 冰箱, 制冷剂, 易燃, 易爆, 泄漏, 制冰, 分配器, 螺旋, 电机, 驱动电路, 第一壳体, 第二壳体; REFRIGERATOR, REFRIGERANT, LEAK+, ICE, MAKER, DISPENSER, SCREW, FEEDER, STORE, DRIVE, CIRCUIT, CASE, HOUSE, SHELL, INFLAMMABLE																		
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CN 106257186 A (DONGBU DAEWOO ELECTRONICS CORPORATION) 28 December 2016 (2016-12-28) description, pages 4-5, and figures 1-8</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 106257167 A (DONGBU DAEWOO ELECTRONICS CORPORATION) 28 December 2016 (2016-12-28) entire document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 106918176 A (SAMSUNG ELECTRONICS CO., LTD.) 04 July 2017 (2017-07-04) entire document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 101530832 A (CHEN, Qiyue) 16 September 2009 (2009-09-16) entire document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 107231062 A (JOHNSON ELECTRIC (SHENZHEN) CO., LTD.) 03 October 2017 (2017-10-03) entire document</td> <td>1-16</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	CN 106257186 A (DONGBU DAEWOO ELECTRONICS CORPORATION) 28 December 2016 (2016-12-28) description, pages 4-5, and figures 1-8	1-16	A	CN 106257167 A (DONGBU DAEWOO ELECTRONICS CORPORATION) 28 December 2016 (2016-12-28) entire document	1-16	A	CN 106918176 A (SAMSUNG ELECTRONICS CO., LTD.) 04 July 2017 (2017-07-04) entire document	1-16	A	CN 101530832 A (CHEN, Qiyue) 16 September 2009 (2009-09-16) entire document	1-16	A	CN 107231062 A (JOHNSON ELECTRIC (SHENZHEN) CO., LTD.) 03 October 2017 (2017-10-03) entire document	1-16
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Date of the actual completion of the international search 16 December 2021	Date of mailing of the international search report 31 December 2021																	
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/120997

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