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(54) **REFRIGERATOR APPLIANCE HAVING A DRAIN PAN**

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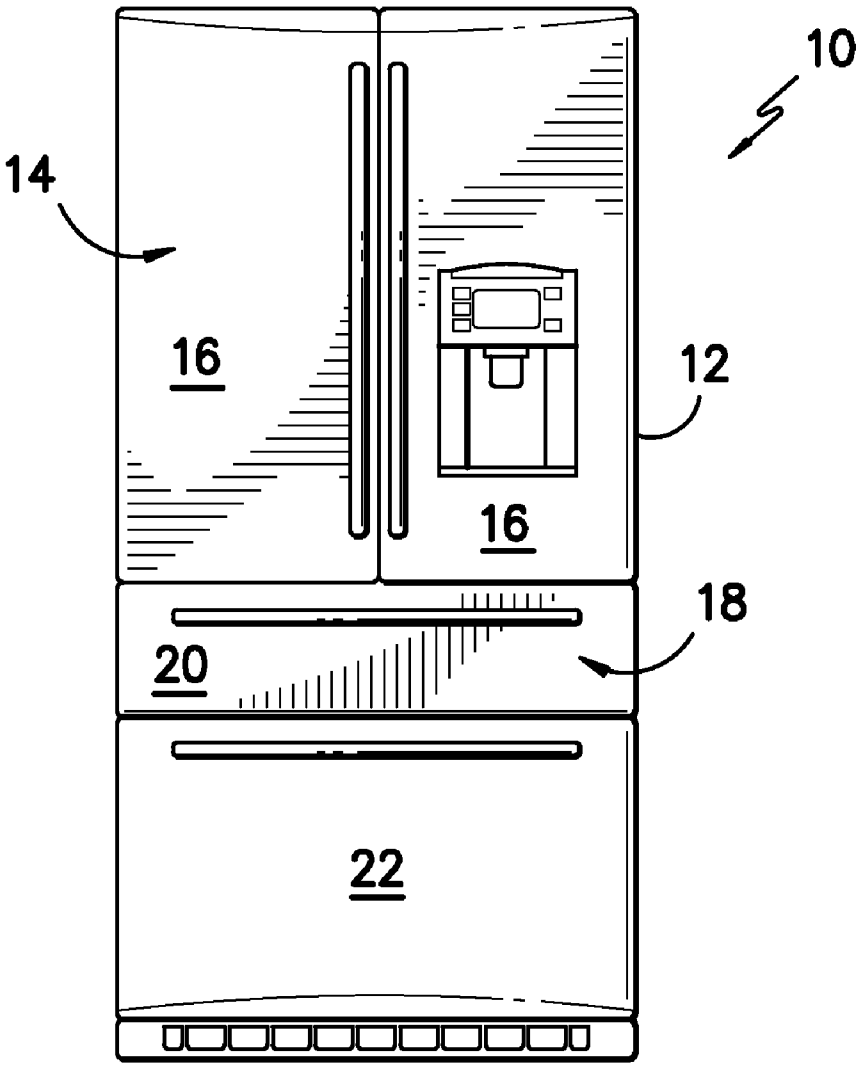
(57) **ABSTRACT**

A refrigerator appliance is provided with a drain pan mounted below a condenser of the refrigerator appliance. The drain pan includes features such as a channel for directing air through the drain pan. The channel can, e.g., increase the efficiency of the condenser and/or promote evaporation of liquid contained within the drain pan.



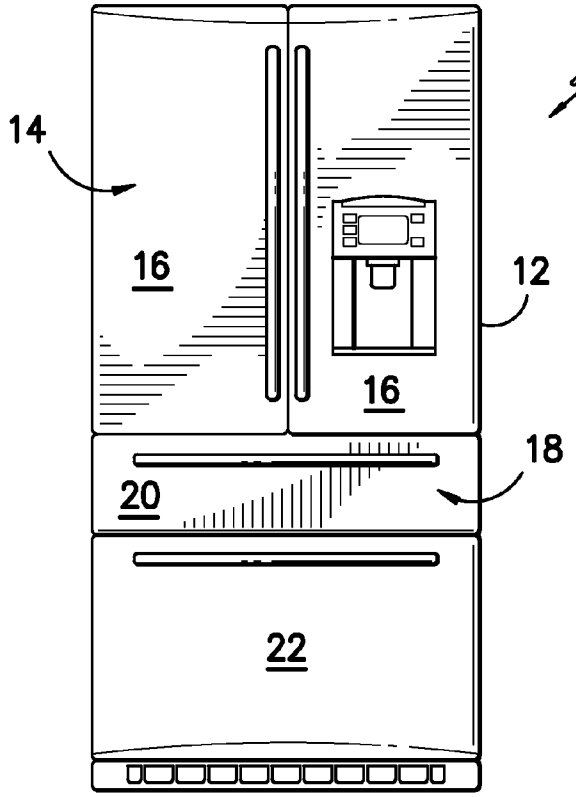


FIG. –1–

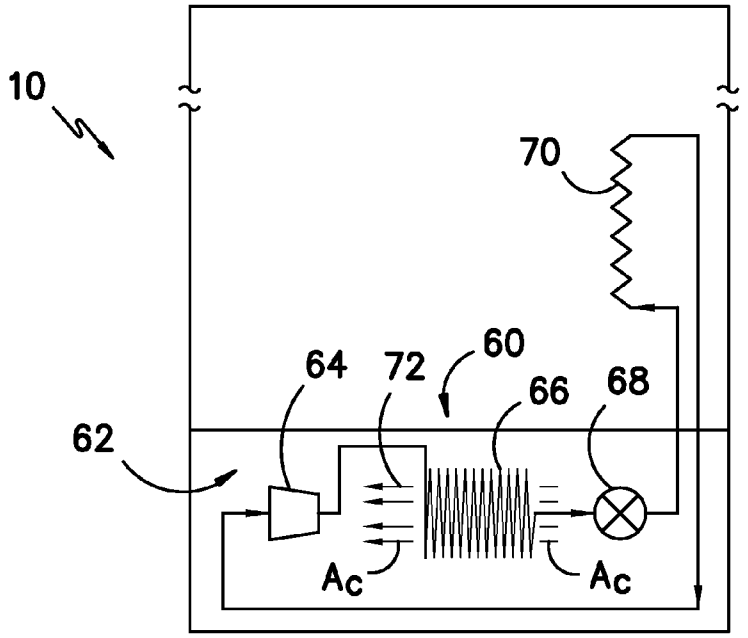


FIG. –2–

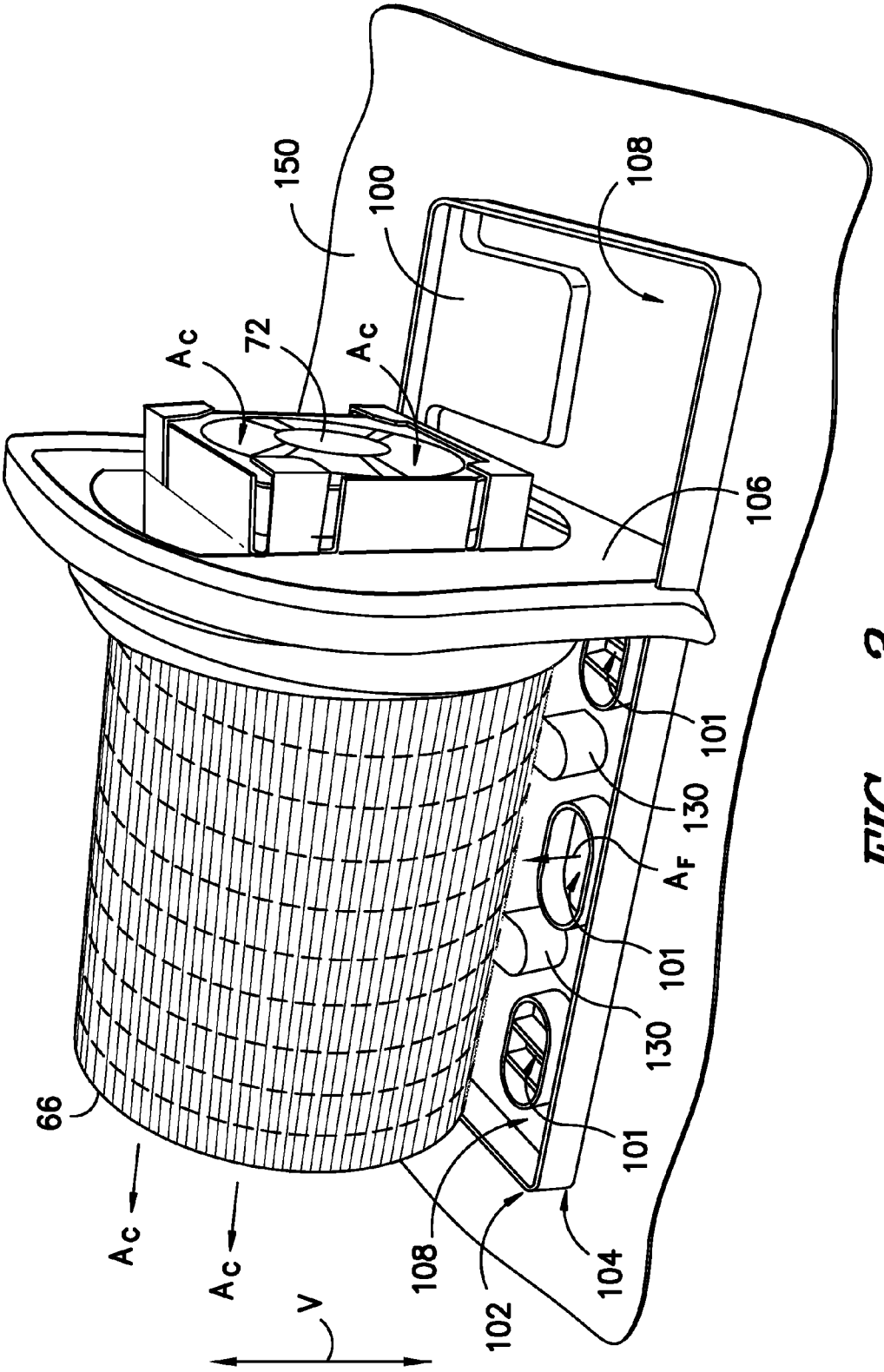

150
100
108
72
A_C
A_C
106
101
130
A_F
101
130
101
66
A_C
A_C
V
108
102
104

FIG. -3-

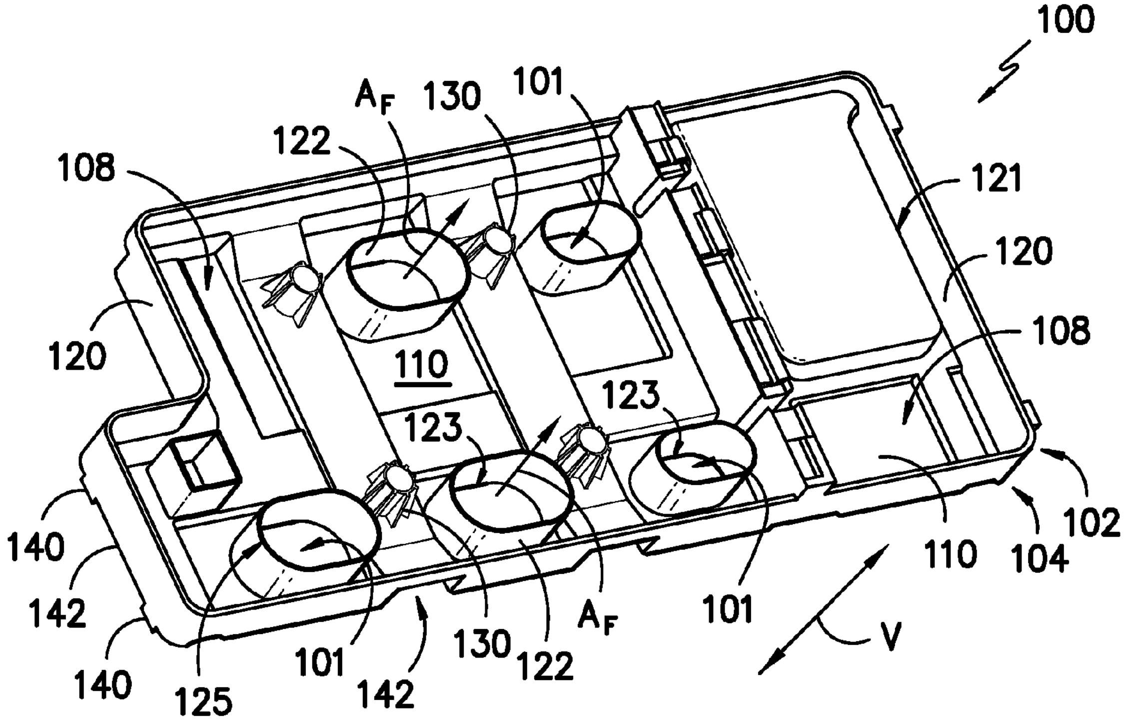

100
101
130
A_F
122
121
108
120
120
108
110
123
123
102
140
104
110
142
101
140
101
130
122
A_F
V
125
142

FIG. −4−

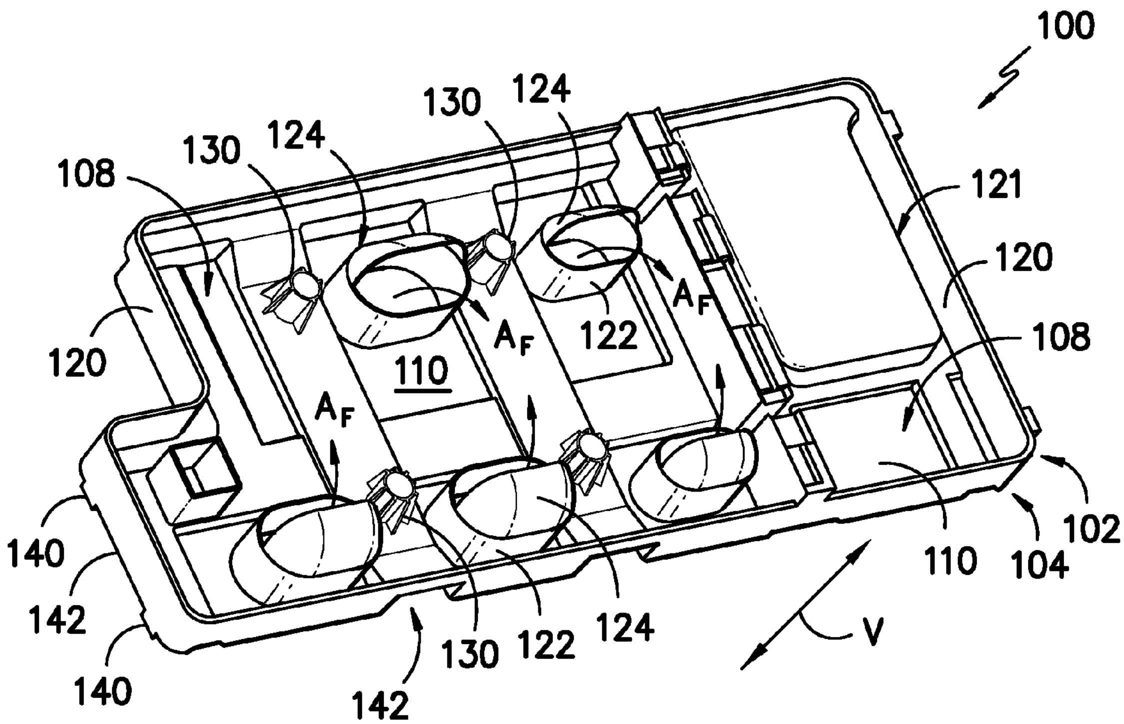

100
124
130
124
130
121
108
120
120
A_F
A_F
122
108
110
A_F
102
140
104
110
142
140
130
122
124
V
142

FIG. −5−

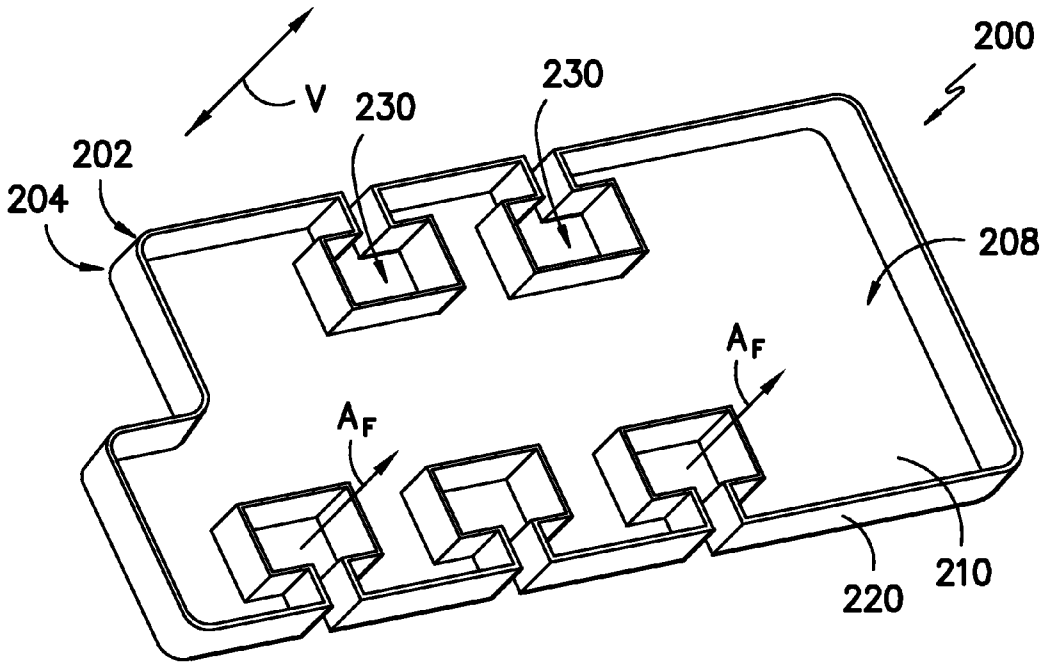

200
V
230
230
202
204
208
A_F
A_F
220
210

FIG. —6—

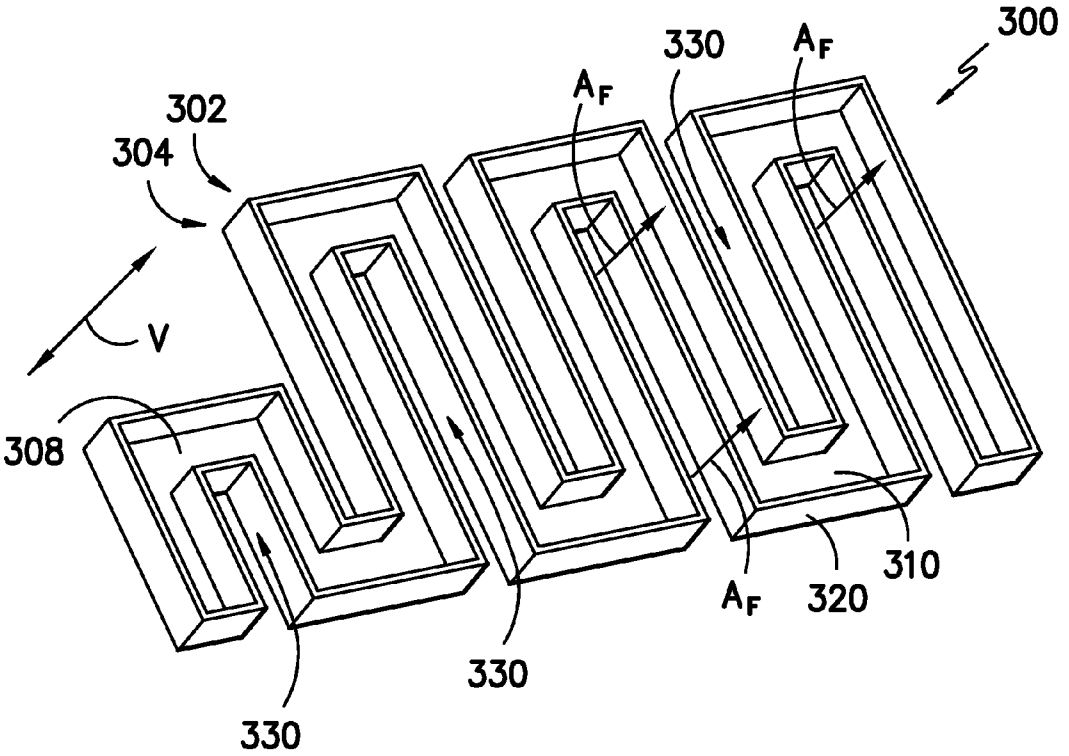

300
330
A_F
A_F
302
304
V
308
310
A_F
320
330
330

FIG. —7—

REFRIGERATOR APPLIANCE HAVING A DRAIN PAN

FIELD OF THE INVENTION

[0001] The present invention relates generally to drain pans for refrigerator appliances.

BACKGROUND OF THE INVENTION

[0002] Consumer refrigerator appliances generally utilize a relatively simple vapor compression refrigeration apparatus that includes a compressor, a condenser, an expansion device, and an evaporator connected in series. The system is charged with a refrigerant such as R-134a. During operation, pressurized liquid refrigerant from the compressor and condenser enters the expansion device. Upon exiting the expansion device and entering the evaporator, the refrigerant drops in pressure and changes phase from a liquid to a gas.

[0003] Due to the pressure drop and phase change of the refrigerant in the evaporator, heat from a chilled chamber of the refrigerator appliance (e.g., a freezer chamber or a fresh food chamber) is transferred to the refrigerant within the evaporator. However, during the heat transfer, water vapor within the chilled chamber can freeze upon contact with the evaporator and create a frost buildup. Such frost buildup can grow in size until it negatively affects operation of the refrigerator appliance. Accordingly, certain refrigerator appliance include a defrost cycle during which such frost buildup melts and is removed from the evaporator.

[0004] When the frost buildup melts, a significant amount of liquid (e.g., water) can be generated. In certain refrigerator appliances, such liquid is directed to a drain pan disposed outside of the chilled chamber wherein the liquid evaporates. However, because a significant amount of liquid can be generated, a significant amount of time may be needed for the liquid to evaporate.

[0005] To promote evaporation, the drain pan can be positioned adjacent the condenser that operates at a relatively high temperature relative to the liquid. However, the effectiveness of such a configuration can be limited. To further promote evaporation, a fan can direct air, e.g., heated air from the condenser, towards the liquid. Similarly, a heater can be mounted within or adjacent the drain pan in order to increase the temperature of the liquid and encourage evaporation. However, such mechanisms consume energy and can decrease the efficiency of the appliance. Such mechanisms also add to the cost of producing the refrigerator appliance.

[0006] Accordingly, a refrigerator appliance with features for improving evaporation of liquid within a drain pan of the refrigerator appliance would be useful. In particular, a drain pan with features for improving evaporation of liquid within the drain pan without requiring additional energy consumption by the appliance would be useful.

BRIEF DESCRIPTION OF THE INVENTION

[0007] A refrigerator appliance is provided with a drain pan mounted below a condenser of the refrigerator appliance. The drain pan includes features such as a channel for directing air through the drain pan. The channel can, e.g., increase the efficiency of the condenser and/or promote evaporation of liquid contained within the drain pan. Aspects and advantages of the invention will be set forth in part in the following description, or may be obvious from the description, or may be learned through practice of the invention.

[0008] In a first exemplary embodiment, a refrigerator appliance is provided. The refrigerator appliance includes an evaporator, a condenser, and a drain pan. The drain pan is disposed below the condenser and in fluid communication with the evaporator in order to receive liquid condensate from said evaporator. The drain pan defines a containment volume configured for holding the liquid directed from the evaporator. The drain pan extends between a top and a bottom along a vertical direction. The drain pan has a bottom plate. An outer wall extends away from the bottom plate along the vertical direction. An inner wall also extends away from the bottom plate along the vertical direction. The inner wall defines a channel for directing air through the drain pan along the vertical direction between the bottom of the drain pan and the top of the drain pan.

[0009] In a second exemplary embodiment, a refrigerator appliance is provided. The refrigerator appliance includes an evaporator, a condenser, and a drain pan. The drain pan is disposed below the condenser and configured for collecting liquid condensate directed from the evaporator. The drain pan extends between a top and a bottom along a vertical direction. The drain pan defines at least one channel for directing air through the drain pan along the vertical direction between the top and the bottom of the drain pan.

[0010] In a third embodiment, a drain pan for a refrigerator appliance is provided. The drain pan defines a containment volume configured for holding liquid. The drain pan extends between a top and a bottom along a vertical direction. The drain pan includes a bottom plate and an outer wall extending upwardly from the bottom plate along the vertical direction. The outer wall also extends around a periphery of the bottom plate. An inner wall extends upwardly from the bottom plate along the vertical direction. The inner wall defines a channel for directing a flow of air through the drain pan along the vertical direction between the bottom of the drain pan and the top of the drain pan.

[0011] 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 exemplary embodiments of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] 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, in which:

[0013] FIG. **1** is a front view of a refrigerator appliance according to an exemplary embodiment of the present subject matter.

[0014] FIG. **2** is schematic view of a refrigeration system of the refrigerator appliance of FIG. **1**.

[0015] FIG. **3** illustrates a perspective view of a condenser of the refrigeration system of FIG. **2** mounted above an exemplary embodiment of a drain pan.

[0016] FIG. **4** illustrates a perspective view of the drain pan of FIG. **3** with the condenser removed for clarity and, in particular, illustrates channels defined by the drain pan.

[0017] FIG. **5** provides a perspective view of the drain pan of FIG. **3** with hoods mounted to the drain pan.

[0018] FIG. **6** illustrates a perspective view of a drain pan according to an additional exemplary embodiment of the present subject matter.

[0019] FIG. **7** provides a perspective view of a drain pan according to another exemplary embodiment of the present subject matter.

DETAILED DESCRIPTION

[0020] 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.

[0021] FIG. **1** depicts a consumer refrigeration appliance **10** in the form of a refrigerator that may incorporate a sealed refrigeration system in accordance with aspects of the invention. It should be appreciated that the term "consumer refrigeration appliance" is used in a generic sense herein to encompass any manner of refrigeration appliance, such as a freezer, refrigerator/freezer combination, and any style or model of conventional refrigerator. In the illustrated exemplary embodiment, the refrigerator **10** is depicted as an upright refrigerator having a cabinet or casing **12** that defines a number of internal storage compartments. In particular, the refrigerator **10** includes upper fresh-food compartments **14** having doors **16** and lower freezer compartment **18** having upper drawer **20** and lower drawer **22**. The drawers **20**, **22** are "pull-out" drawers in that they can be manually moved into and out of the freezer compartment **18** on suitable slide mechanisms.

[0022] FIG. **2** is a schematic view of refrigerator **10** including an exemplary sealed refrigeration system **60**. A machinery compartment **62** contains components for executing a known vapor compression cycle for cooling air. The components include a compressor **64**, a condenser **66**, an expansion valve **68**, and an evaporator **70** connected in series and charged with a refrigerant. As will be understood by those skilled in the art, refrigeration system **60** may include additional components, e.g., at least one additional evaporator, compressor, expansion valve, and/or condenser. As an example, refrigeration system **60** may include two evaporators.

[0023] Within refrigeration system **60**, gaseous refrigerant flows into compressor **64**, which operates to increase the pressure of the refrigerant. This compression of the refrigerant raises its temperature, which is lowered by passing the gaseous refrigerant through condenser **66**. Within condenser **66**, heat exchange with ambient air takes place so as to cool the refrigerant and cause the refrigerant to condense to a liquid state. A fan **72** is used to pull air across condenser **66**, as illustrated by arrows A_C, so as to provide forced convection for a more rapid and efficient heat exchange between the refrigerant within condenser **66** and the ambient air. Thus, as will be understood by those skilled in the art, increasing air flow across condenser **66** can, e.g., increase the efficiency of condenser **66** by improving cooling of the refrigerant contained therein.

[0024] An expansion device (e.g., a valve, capillary tube, or other restriction device) **68** receives liquid refrigerant from condenser **66**. From expansion device **68**, the liquid refrigerant enters evaporator **70**. Upon exiting expansion device **68** and entering evaporator **70**, the liquid refrigerant drops in pressure and vaporizes. Due to the pressure drop and phase change of the refrigerant, evaporator **70** is cool relative to compartments **14**, **18** of refrigerator **10** (FIG. **1**). As such, cooled air is produced and configured to refrigerate compartments **14**, **18** of refrigerator **10** (FIG. **1**). Thus, evaporator **70** is a type of heat exchanger which transfers heat from air passing over evaporator **70** to refrigerant flowing through evaporator **70**.

[0025] Collectively, the vapor compression cycle components in a refrigeration circuit, associated fans, and associated compartments are sometimes referred to as a sealed refrigeration system operable to force cold air through refrigeration compartments **14**, **18** (FIG. **1**). The refrigeration system **60** depicted in FIG. **2** is provided by way of example only. Thus, it is within the scope of the present subject matter for other configurations of the refrigeration system to be used as well.

[0026] It should be understood that during operation of refrigeration system **60** water vapor, e.g., from air within refrigeration compartments **14**, **18** (FIG. **1**) can freeze upon contact with evaporator **70**. For example, refrigerant within evaporator **70** may reach a temperature below the freezing point of water. Thus, water vapor contacting evaporator **70** may freeze and create a frost buildup (not shown) on evaporator **70**. Such frost buildup may continue to grow during operation of refrigeration system **60**. For example, when a user opens freezer doors **20**, **22** and permits fresh water vapor containing air to enter freezer chamber **18**.

[0027] To avoid potential negative effects of such frost build up on refrigeration system **60** operation, refrigeration system **60** is configured for executing a defrost cycle. For example, refrigeration system **60** may deactivate compressor **64** for a period of time sufficient for the frost buildup on evaporator **70** to melt. However, when the frost buildup melts, a volume of liquid runoff (e.g, water) is produced that can freeze upon reactivation of compressor **64** and negatively affect refrigeration system **60** and, in particular, evaporator **70**. Thus, such liquid runoff is directed away from evaporator **70**, e.g., using a tube, pipe, conduit, trench, or other suitable mechanism (not shown). In the exemplary embodiment shown in FIG. **2**, the liquid runoff is directed to a drain pan **100** as shown in FIG. **3** below.

[0028] FIG. **3** illustrates a perspective view of condenser **66** of refrigeration system **60** (FIG. **2**) mounted above drain pan **100**. In FIG. **3**, fan **72** is mounted to a support wall **106** that extends from drain pan **100**, e.g., along a vertical direction V. In addition, condenser **66** rests upon posts **130** that extend upwardly from drain pan **100** along the vertical direction V. As discussed above, fan **72** urges a flow of cooling air A_C through condenser **66**. It should be under stood that condenser **66** need not be supported by drain pan **100** and may be mounted above drain pan **100** in any suitable manner.

[0029] Drain pan **100** extends between a top **102** and a bottom **104** along the vertical direction V. Between top **102** and bottom **104**, drain pan **100** defines a containment volume **108**. Containment volume **108** is configured for receipt of the liquid runoff from evaporator **70** (FIG. **2**) discussed above.

Within containment volume **108**, such liquid runoff is permitted to evaporate. More particularly, certain components of refrigeration cycle **60** and drain pan **100** may be directed towards facilitating and assisting evaporation of liquid runoff within containment volume **108**. For example, condenser **66** operates at an elevated temperature relative to the liquid runoff. Thus, air about condenser **66** can be heated and assist evaporation of the liquid runoff. More directly, fan **72** can direct a portion of flow A_C across and/or into containment volume **108** in order to assist evaporation of the liquid runoff.

[0030] Regarding drain pan **100**, drain pan **100** defines vents or channels **101** for assisting evaporation of the liquid runoff. For example, channels **101** are configured for directing a flow of air A_F through drain pan **100**. Channels **101** direct air from bottom **104** to top **102** of drain pan **100** as discussed in greater detail below. As an example, air may be urged through channels **101** by convective currents generated by condenser **66**. As heated air rises from condenser **66**, cooler air within channels **101** may be drawn upwardly, and such air may assist in cooling condenser **66**. Thus, e.g., condenser **66** may function more efficiently due to cooling air carried within flow A_F.

[0031] FIG. **4** illustrates a perspective view of drain pan **100** with condenser **66** removed for clarity. As may be seen in FIG. **4**, drain pan **100** includes a base plate or bottom plate **110** that supports posts **130**. An outer sidewall **120** extends around or about an outer edge or perimeter **121** of bottom plate **110**. Outer sidewall **120** also extends upwardly from bottom plate **110** along the vertical direction V. Like outer sidewall **120**, inner sidewalls **122** extend upwardly from bottom plate **110** along the vertical direction V from inner edges **123** of bottom plate **110**.

[0032] In FIG. **4**, channels **101** are defined by inner sidewalls **122**. Channels **101** also extend along the vertical direction V and are enclosed by inner sidewalls **122**. In FIG. **4**, bottom plate **110**, outer sidewall **120**, and inner sidewalls **122** also assist in defining containment volume **108**. Thus, for example, outer sidewall **120** and inner sidewalls **122** extend between top **102** and bottom **104** of drain pan **100** to hold liquid within containment volume **108**. In FIGS. **3-5**, channels **101** are substantially circular. However, in alternative exemplary embodiments, channels **101** may have any suitable shape, e.g., oval and/or rectangular.

[0033] As discussed above, channels **101** direct flow of air A_F from bottom **104** to top **102** of drain pan **100**. To facilitate flow of air A_F, drain pan **100** includes a plurality of legs **140** that extend downwardly from bottom plate **110**. By extending downwardly, plurality of legs **140** assist bottom plate **110** in defining a space or gap **142** beneath drain pan **100**. Gap **142** is defined between pan **100** and a floor or other (e.g., substantially flat) support surface **150** (FIG. **3**) on which drain pan **100** rests. Thus, for example, air can enter gap **142** adjacent bottom **104** of drain pan **100**. Such air can flow through gap **142** beneath bottom plate **110** and enter channels **101**. Such air is then directed through channels **101** as flow of air A_F and passes through channels **101** from bottom **104** to top **102** of drain pan **100**.

[0034] Upon exiting channels **101**, inner sidewalls **122** may, e.g., direct flow of air A_F along the vertical direction V towards condenser **66** (FIG. **3**). By directing flow of air A_F towards condenser **66**, channels **101** and, more generally, drain pan **100** may increase the efficiency of condenser **66**. For example, flow of air A_F can assist in cooling refrigerant within condenser **66**. Conversely, flow of air A_F can also assist in evaporation of liquid held within containment volume **108**. For example, flow of air A_F exiting channels **101** can flow across liquid within containment volume **108**. Drain pan **100** may include additional features for altering the direction flow of air A_F in order to further assist evaporation of liquid in containment volume **108** as discussed in greater detail below.

[0035] FIG. **5** provides a perspective view of drain pan **100** with hoods **124** disposed on a top or a distal end **125** of inner sidewalls **122**. As may be seen in FIG. **5**, hoods **124** are configured for directing flow of air A_F. For example, hoods **124** may direct flow of air A_F towards, into, and/or across containment volume **108**. By directing the flow of air A_F into, towards, and/or across containment volume **108**, hoods **124** can, e.g., direct greater amounts of air across liquid within containment volume **108** compared to channels **101** shown in FIG. **4** in order to further facilitate evaporation of the liquid. Hoods **124** may be an integral component of inner sidewalls **122**. Alternatively, hoods **124** may be a separate component that is secured in place on top **125** of inner sidewalls **122**, e.g., using glue, fasteners, snaps, or any other suitable mechanism.

[0036] FIG. **6** illustrates a perspective view of a drain pan **200** according to an additional exemplary embodiment. Drain pan **200** is substantially similar to drain pan **100** of FIGS. **3-5**. For example, drain pan **200** includes a bottom plate **210** and an outer sidewall **220** that extends upwardly from bottom plate **210** in the vertical direction V. Bottom plate **210** and outer sidewall **220** help define a containment volume **208** from a bottom **204** to a top **202** of drain pan **200**.

[0037] In FIG. **6**, drain pan **200** assists in defining a plurality of channels **230**. It should be understood that channels **230** function similarly to channels **101** (FIG. **3**). For example, like channels **101**, channels **230** can direct flow of air A_F from bottom **204** to top **202** of drain pan **200**. However, channels **230** are only partially enclosed by outer side wall **220**. Thus, air may enter channels **230** from a side of drain pan **200** not only from bottom **204**. Thus, outer side wall **220** may be configured such that channels **230** are at least partially enclosed by outer side wall **220**.

[0038] FIG. **7** provides a perspective view of a drain pan **300** according to another exemplary embodiment. Drain pan **300** is substantially similar to drain pans **100** and **200** discussed above. For example, drain pan **300** includes a bottom plate **310** and an outer sidewall **320** that extends upwardly from bottom plate **310** in the vertical direction V. Bottom plate **310** and outer sidewall **320** help define a containment volume **308** from a bottom **304** to a top **302** of drain pan **300**.

[0039] Drain pan **300** assists in defining a plurality of channels **330**. It should be understood that channels **330** function similarly to channels **101** (FIG. **3**) and channels **230** (FIG. **5**). For example, like channels **101** and channels **230**, channels **330** direct flow of air A_F from bottom **204** to top **202** of drain pan **200**. Channels **330** are only partially enclosed by outer side wall **320**. Thus, air may enter channels **330** from a side of drain pan **300** not only from bottom **304**.

[0040] 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.

What is claimed is:

1. A refrigerator appliance comprising:

an evaporator;

a condenser; and

a drain pan disposed below said condenser and in fluid communication with said evaporator so as to receive liquid condensate from said evaporator, said drain pan defining a containment volume configured for holding liquid directed from said evaporator, said drain pan also extending between a top and a bottom along a vertical direction, said drain pan comprising:

a bottom plate;

an outer wall extending upwardly from said bottom plate along the vertical direction, said outer wall also extending around a periphery of said bottom plate; and

an inner wall extending upwardly from said bottom plate along the vertical direction, said inner wall defining a channel for directing a flow of air through said drain pan along the vertical direction between the bottom of said drain pan and the top of said drain pan.

2. The refrigerator appliance of claim **1**, further comprising a hood disposed on a top of said inner wall.

3. The refrigerator appliance of claim **1**, further comprising a fan configured for selectively urging a flow of air through said condenser.

4. The refrigerator appliance of claim **1**, further comprising a plurality of legs extending downwardly from said bottom plate along the vertical direction, said plurality of legs elevating said bottom plate relative to a support surface such that a gap is defined below said bottom plate for permitting a flow of air beneath said bottom plate.

5. The refrigerator appliance of claim **1**, further comprising a plurality of posts extending upwardly from said bottom plate along the vertical direction, said plurality of posts configured for supporting said condenser.

6. The refrigerator appliance of claim **1**, wherein said condenser is positioned adjacent said drain pan such that heat energy from said condenser assists in evaporating liquid contained in the containment volume of said drain pan.

7. The refrigerator appliance of claim **1**, wherein said drain pan is constructed of plastic.

8. A refrigerator appliance comprising:

an evaporator;

a condenser; and

a drain pan disposed below said condenser and in fluid communication with said evaporator so as to collect liquid condensate directed from said evaporator, said drain pan extending between a top and a bottom along a vertical direction, said drain pan defining at least one channel for directing air through said drain pan along the vertical direction between the top and the bottom of said drain pan.

9. The refrigerator appliance of claim **8**, wherein an outer wall of said drain pan partially encloses the at least one channel.

10. The refrigerator appliance of claim **8**, wherein an outer wall of said drain pan encloses the at least one channel.

11. The refrigerator appliance of claim **8**, further comprising a hood disposed adjacent a top of the at least one channel.

12. The refrigerator appliance of claim **8**, further comprising a fan configured for selectively urging a flow of air through said condenser.

13. The refrigerator appliance of claim **8**, further comprising a plurality of legs extending downwardly from said drain pan along the vertical direction, said plurality of legs positioning said drain pan relative to a support surface such that a gap is defined below said drain pan for permitting a flow of air beneath said drain pan.

14. The refrigerator appliance of claim **8**, further comprising a plurality of posts extending upwardly from said drain pan along the vertical direction, said plurality of posts configured for supporting said condenser.

15. The refrigerator appliance of claim **8**, wherein said condenser is positioned adjacent said drain pan such that heat energy from said condenser assists in evaporating liquid contained in said drain pan.

16. The refrigerator appliance of claim **8**, wherein said drain pan is constructed of plastic.

17. A drain pan for an appliance, the drain pan defining a containment volume configured for holding liquid, the drain pan extending between a top and a bottom along a vertical direction, the drain pan comprising:

a bottom plate;

an outer wall extending upwardly from said bottom plate along the vertical direction, said outer wall also extending around a periphery of said bottom plate; and

an inner wall extending upwardly from said bottom plate along the vertical direction, said inner wall defining a channel for directing a flow of air through the drain pan along the vertical direction between the bottom of the drain pan and the top of the drain pan.

18. The drain pan of claim **17**, further comprising a hood disposed adjacent a top of said inner wall.

19. The drain pan of claim **17**, further comprising a plurality of legs extending downwardly from said bottom plate along the vertical direction, said plurality of legs positioning said bottom plate relative to a support surface such that a gap is defined below said bottom plate for permitting a flow of air beneath said bottom plate.

* * * * *