US 20200229645A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0229645 A1**

Karsten et al. (43) **Pub. Date: Jul. 23, 2020**

(54) **FOOD DELIVERY SYSTEMS, APPARATUSES, AND METHODS**

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(21) Appl. No.: **16/717,429**

(22) Filed: **Dec. 17, 2019**

Related U.S. Application Data

(60) Provisional application No. 62/794,051, filed on Jan. 18, 2019.

Publication Classification

(51) **Int. Cl.**

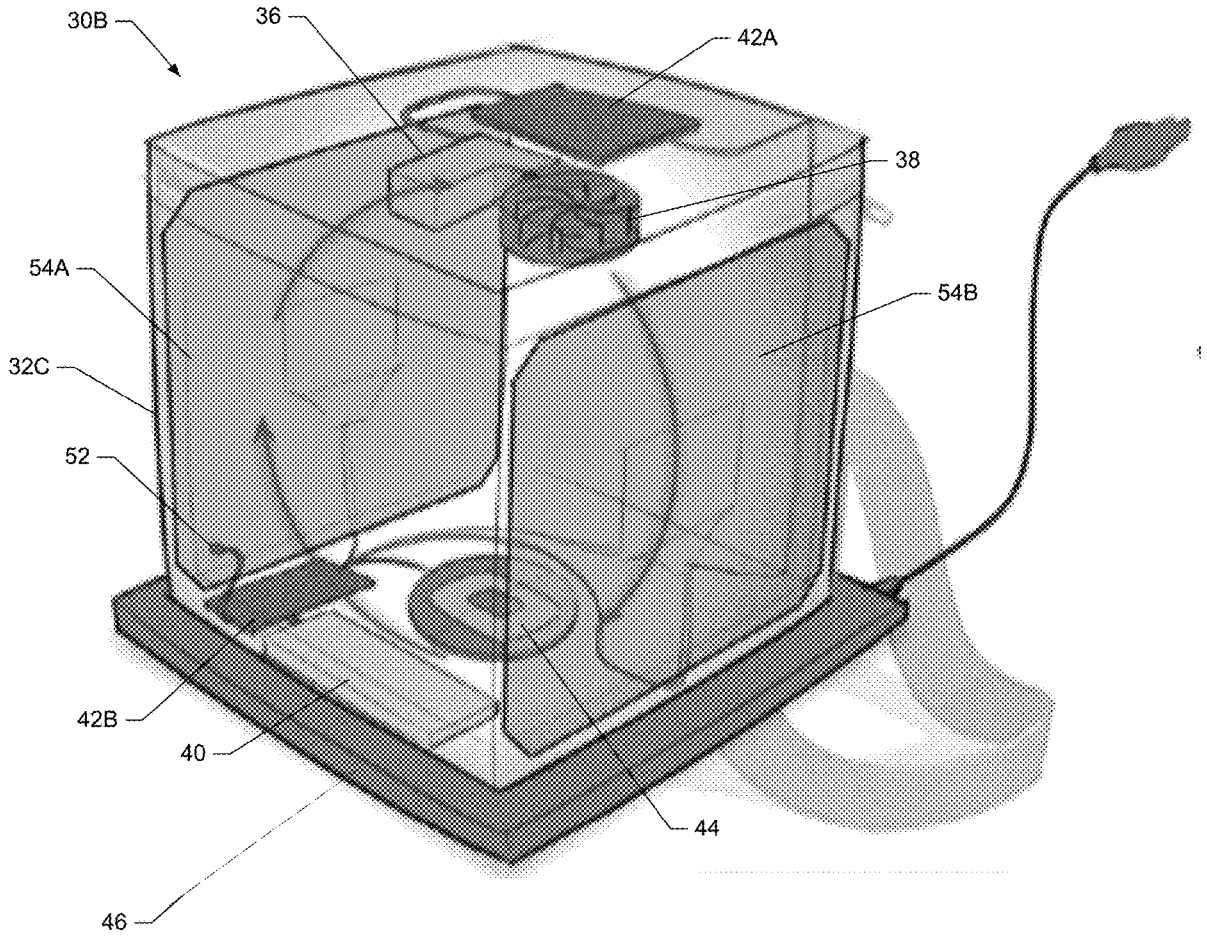
A47J 41/00	(2006.01)
A47J 47/14	(2006.01)
A47J 39/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A47J 41/0094*** (2013.01); ***A47J 47/14*** (2013.01); ***A47J 39/006*** (2013.01); ***A47J 39/003*** (2013.01); ***A47J 41/005*** (2013.01)

(57) **ABSTRACT**

A food delivery container including a plurality of insulated walls that form a food chamber, and a climate control system. The climate control system includes an air flow pathway and a heating and/or cooling element positioned within the air flow pathway. A fan is in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the cooling and/or heating element to circulate heated/cooled air within the food delivery container. The climate control system also includes a power supply configured to supply electrical power to the fan and the cooling/heating element.



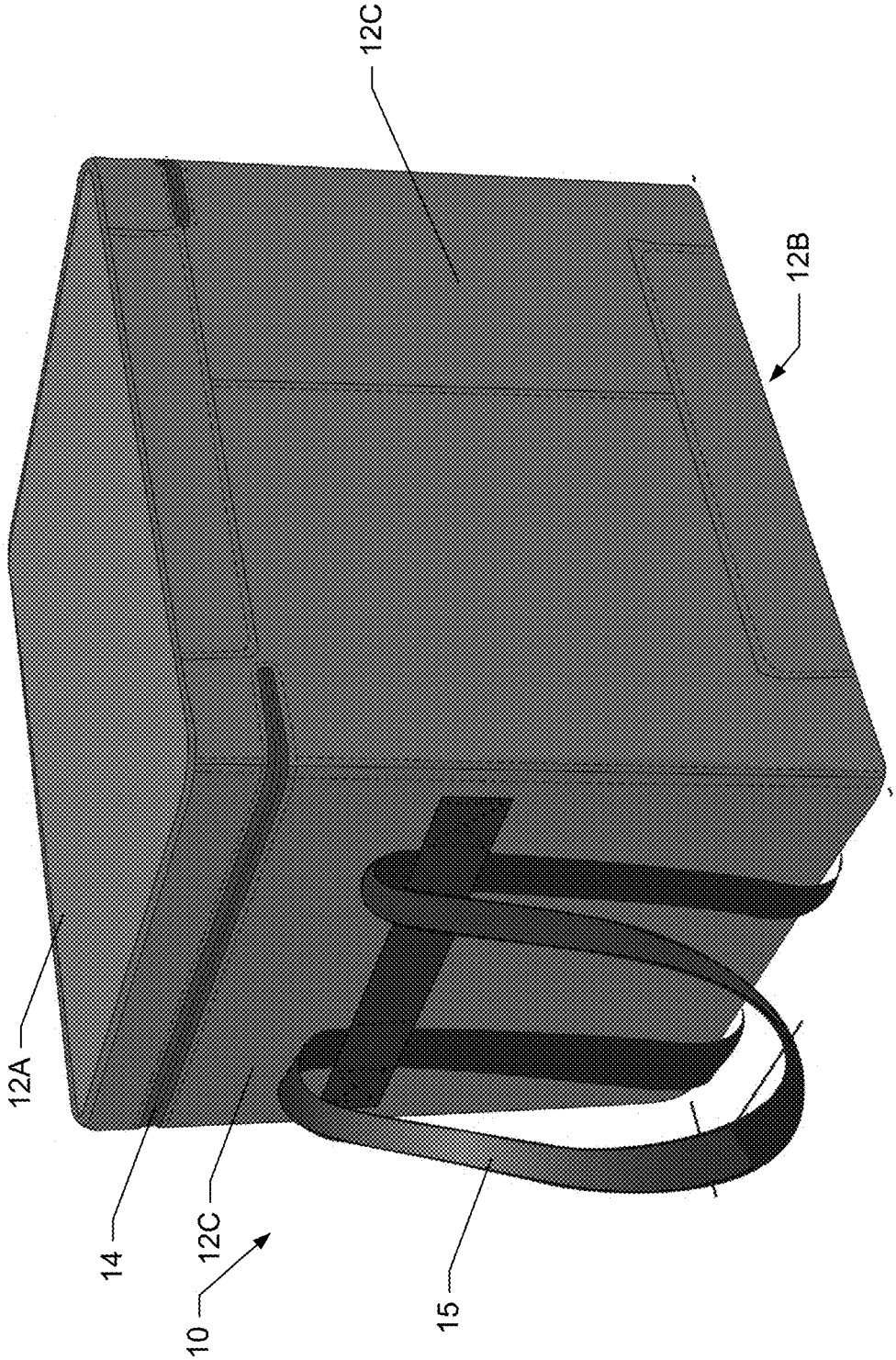


FIG. 1

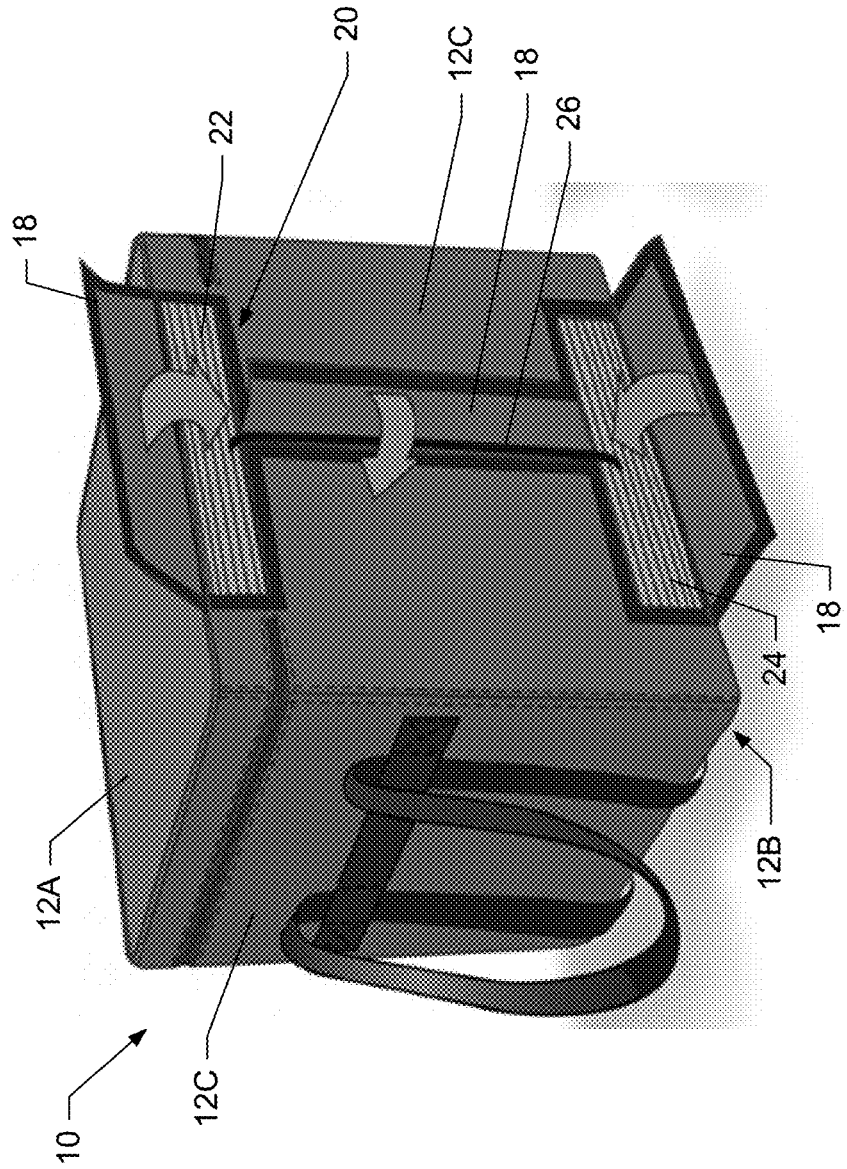


FIG. 2

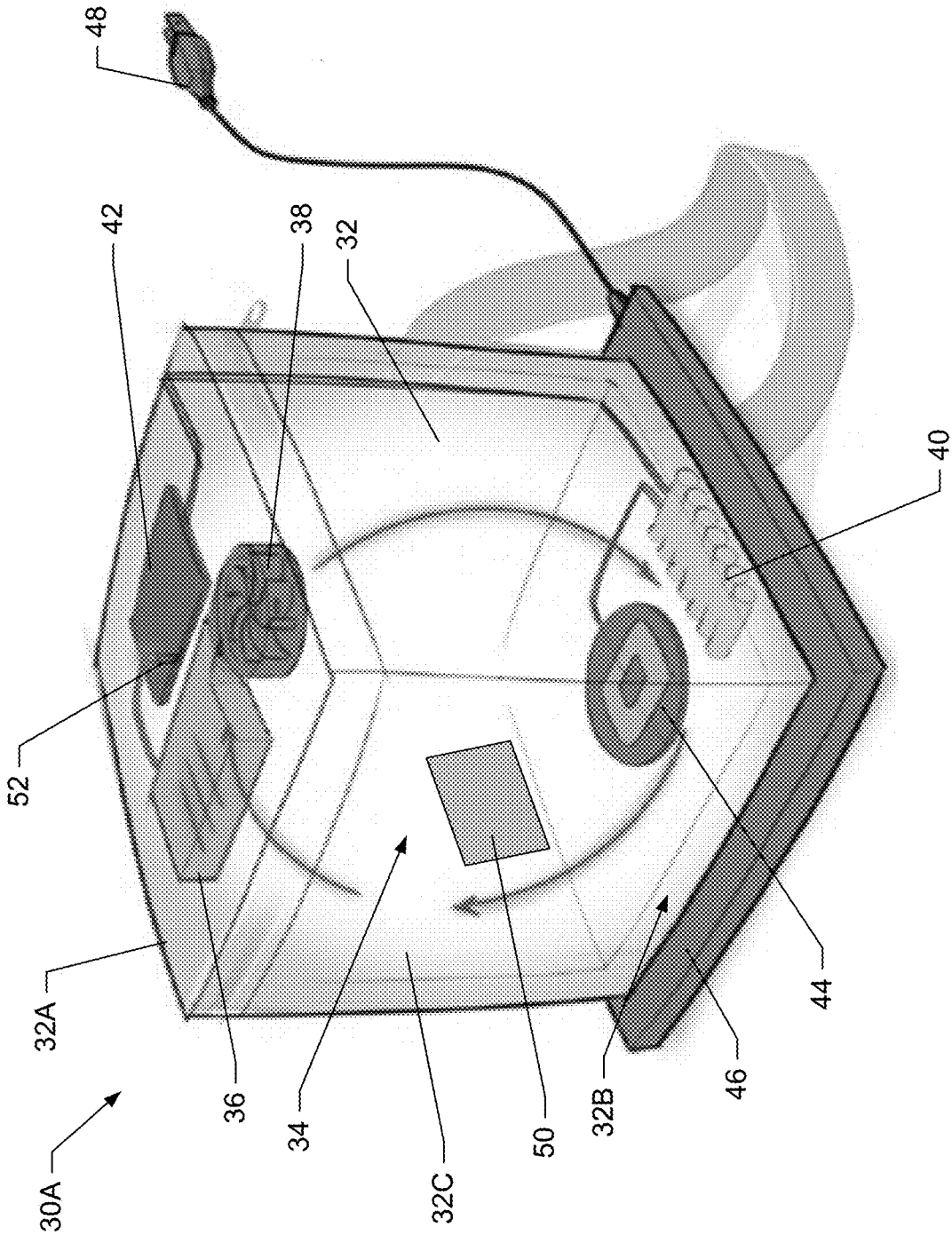


FIG. 3

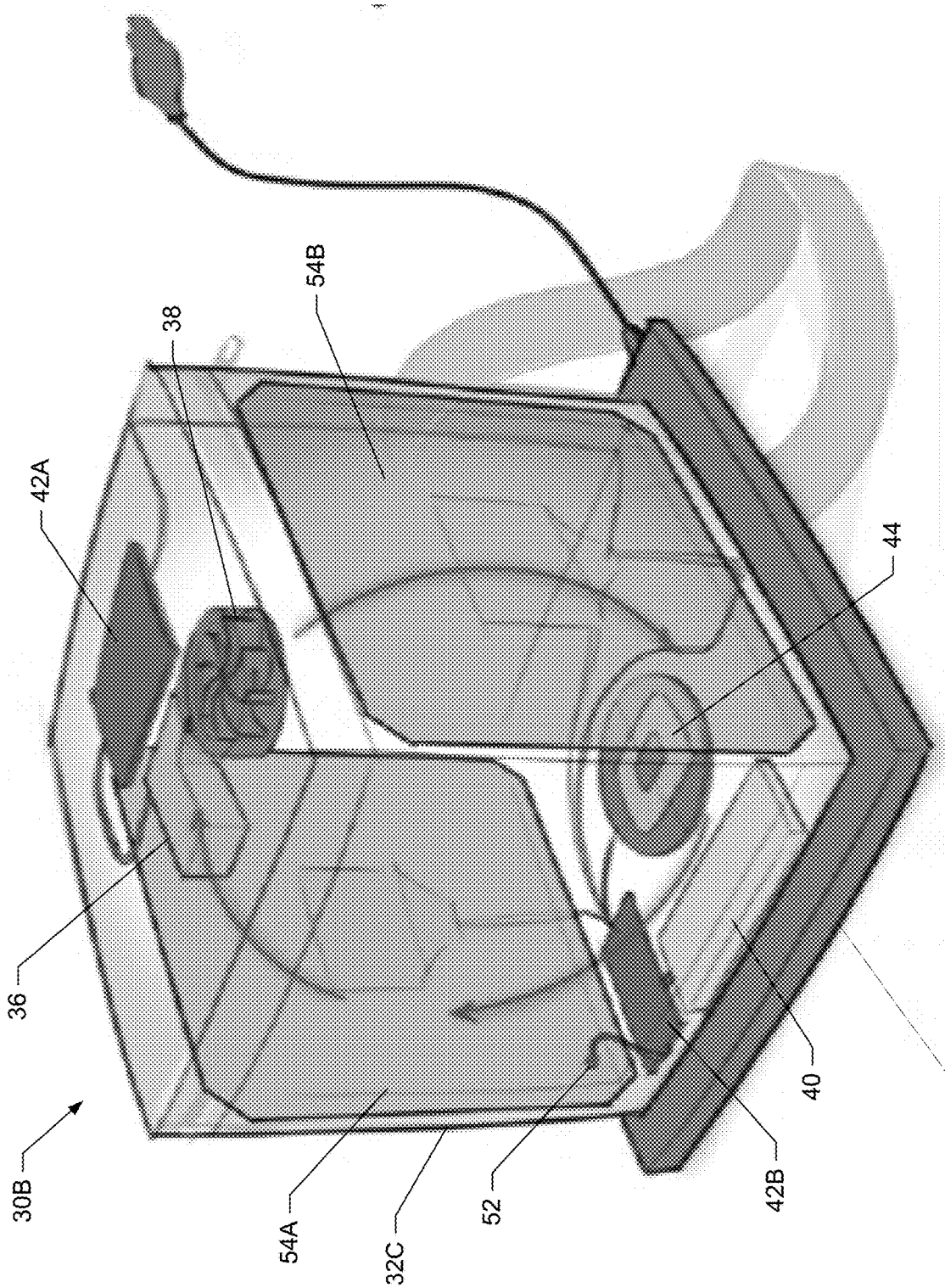


FIG. 4

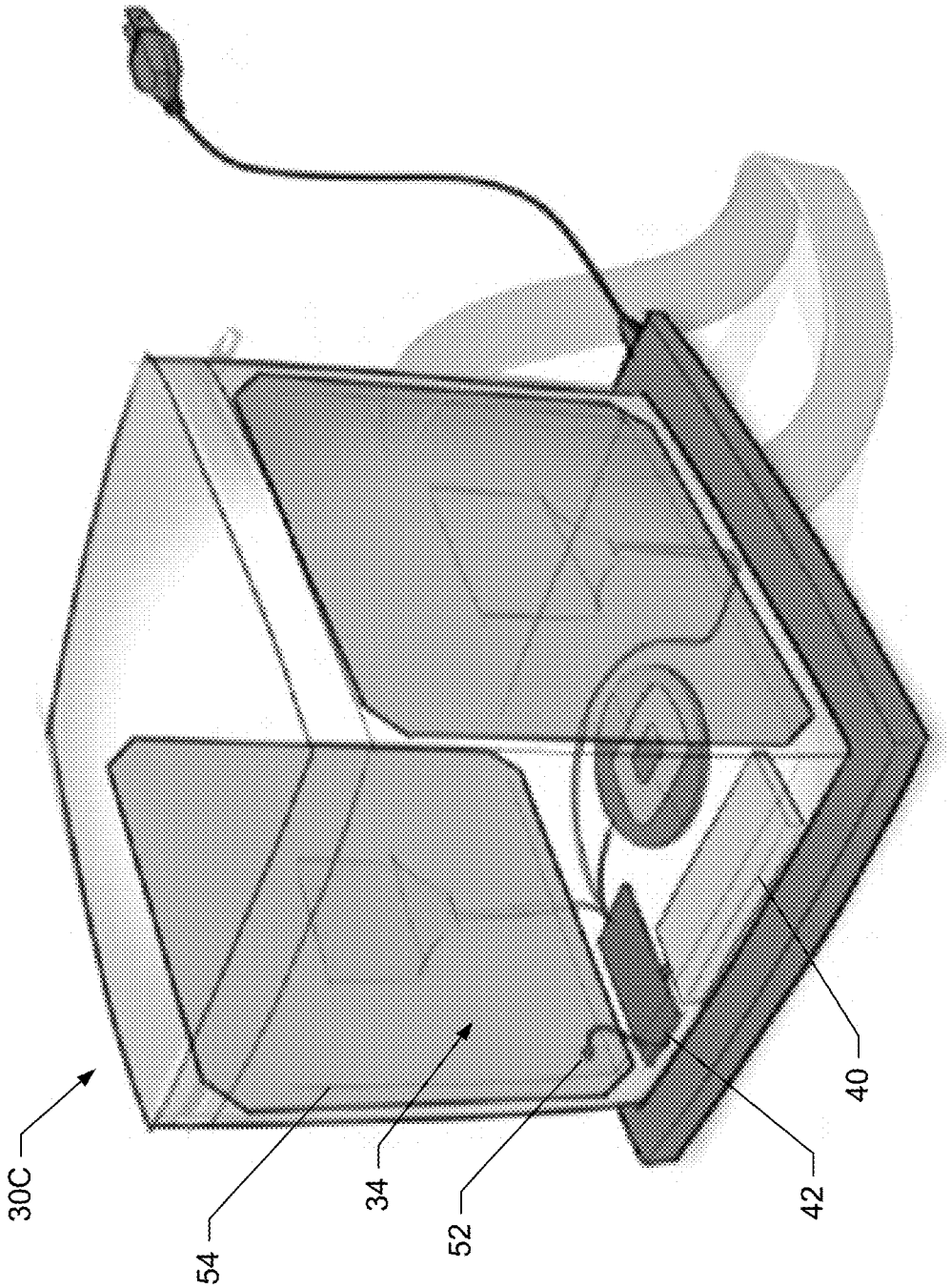


FIG. 5

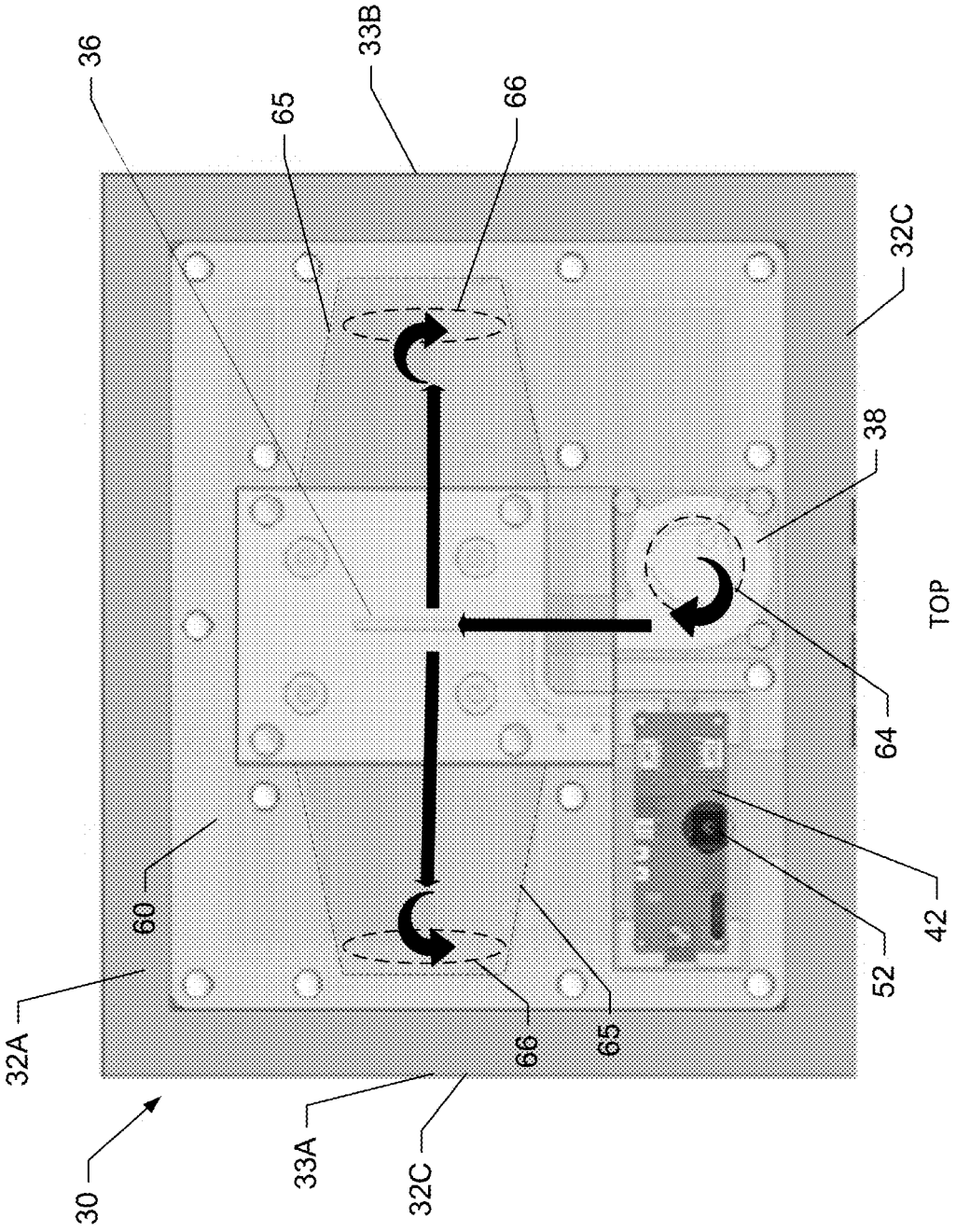


FIG. 6

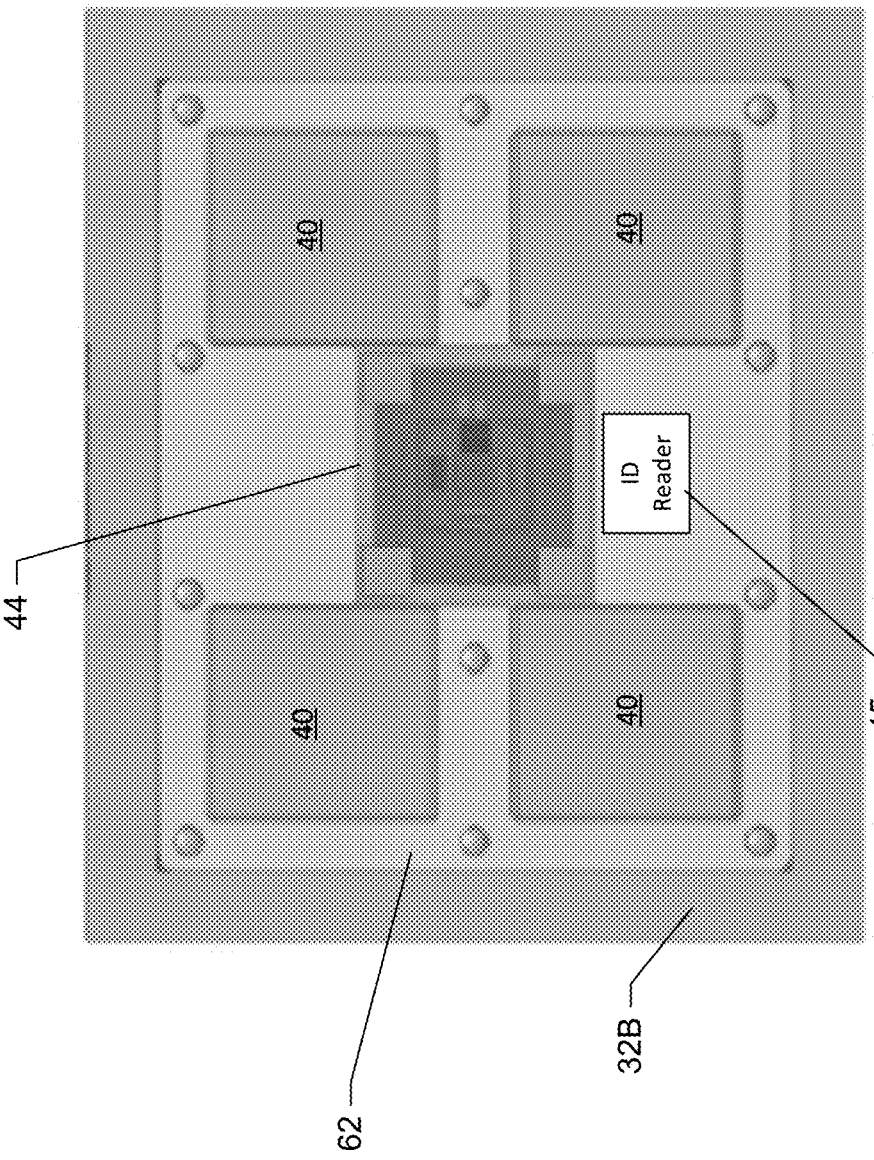


FIG. 7

FIG. 8

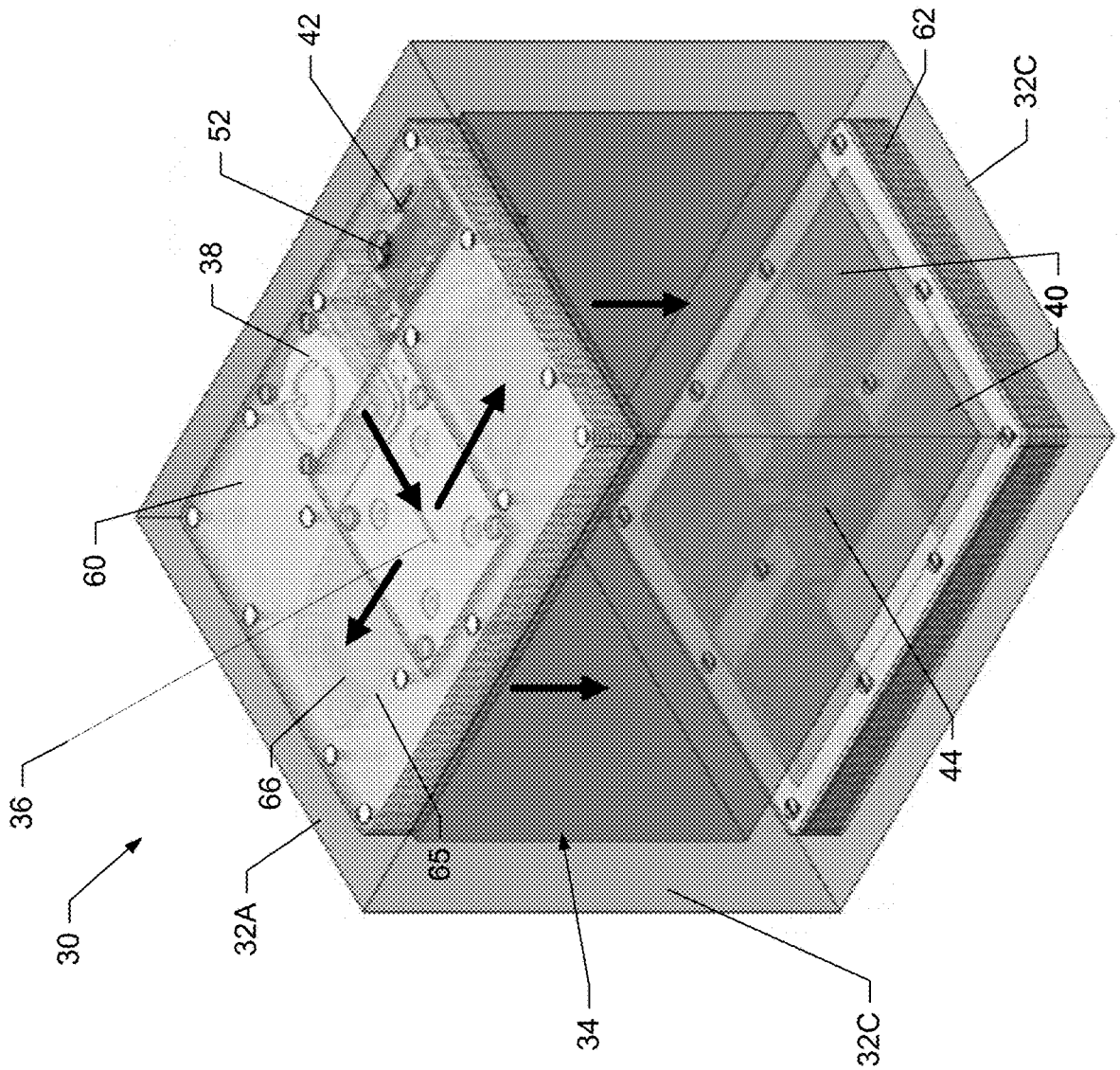
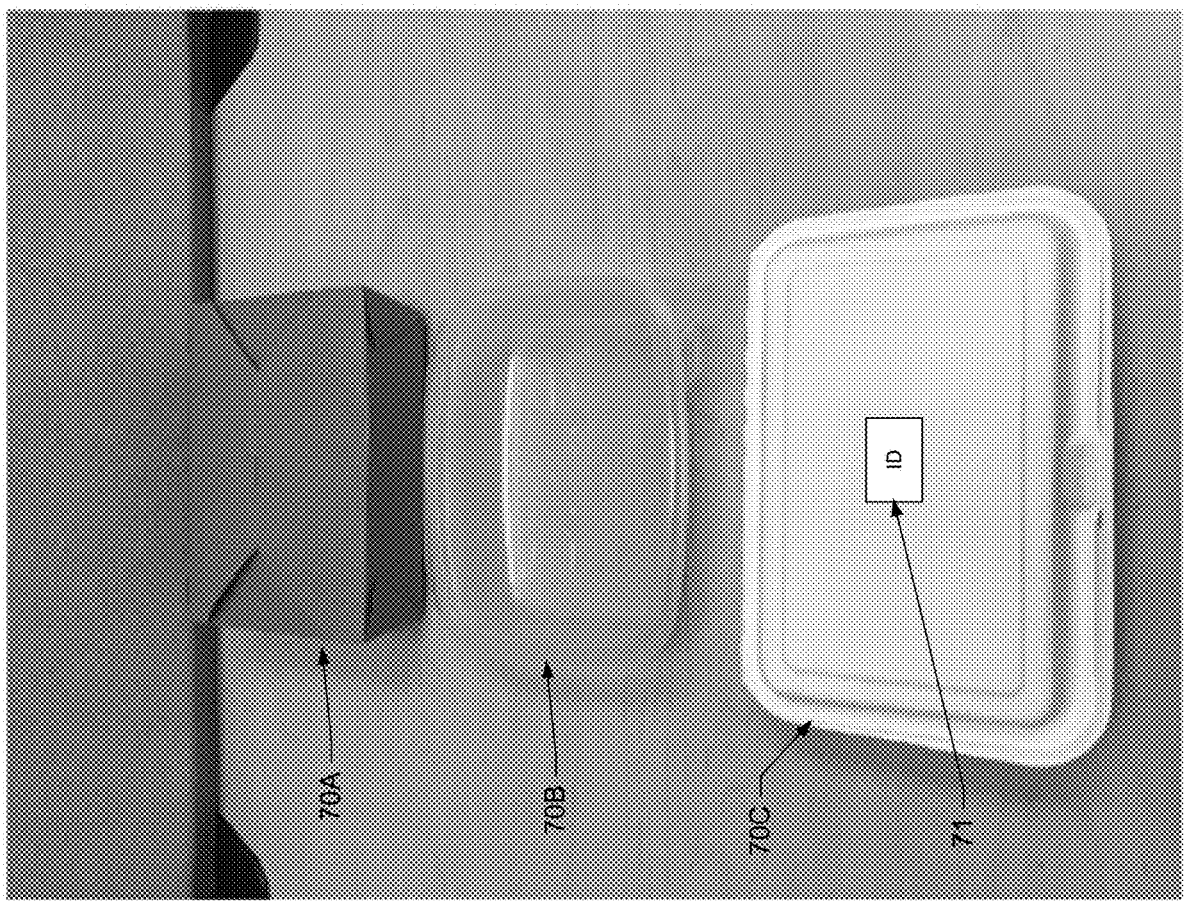


FIG. 9



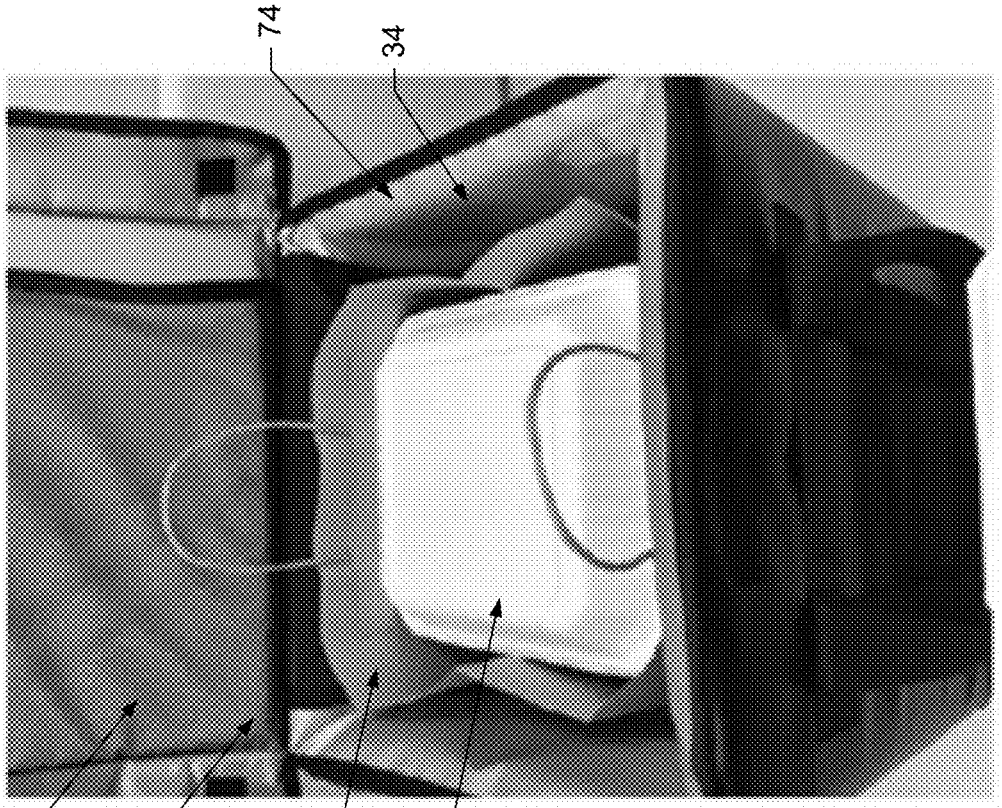


FIG. 10B

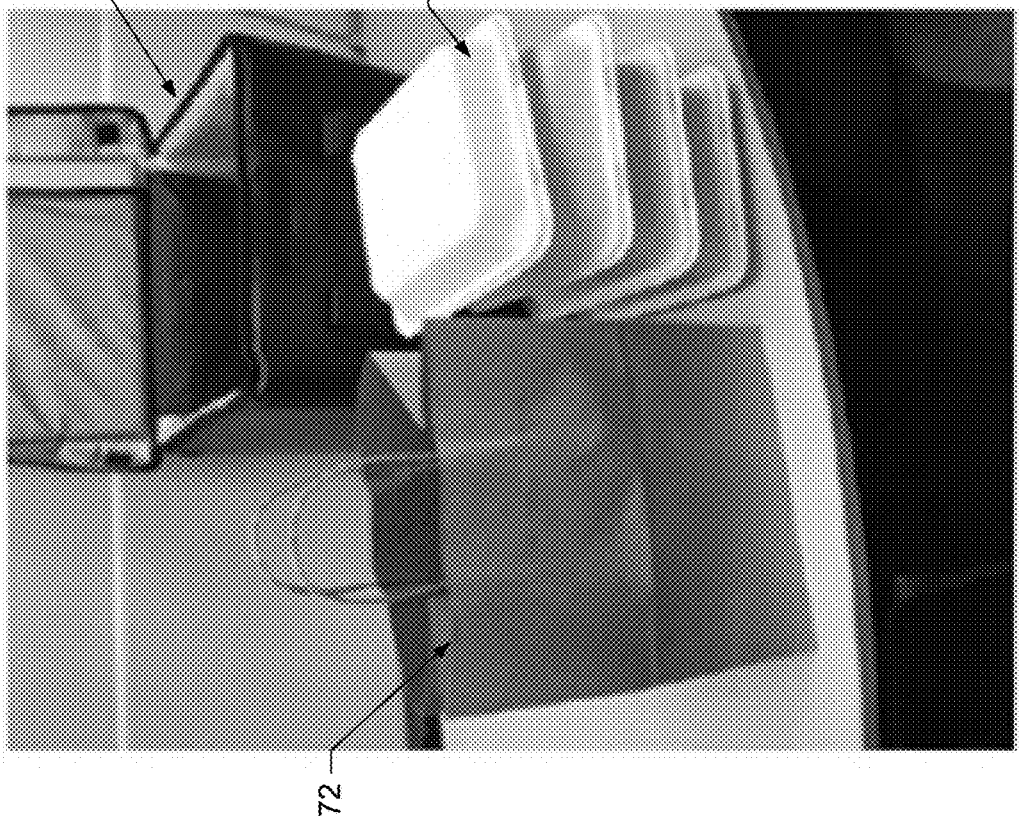


FIG. 10A

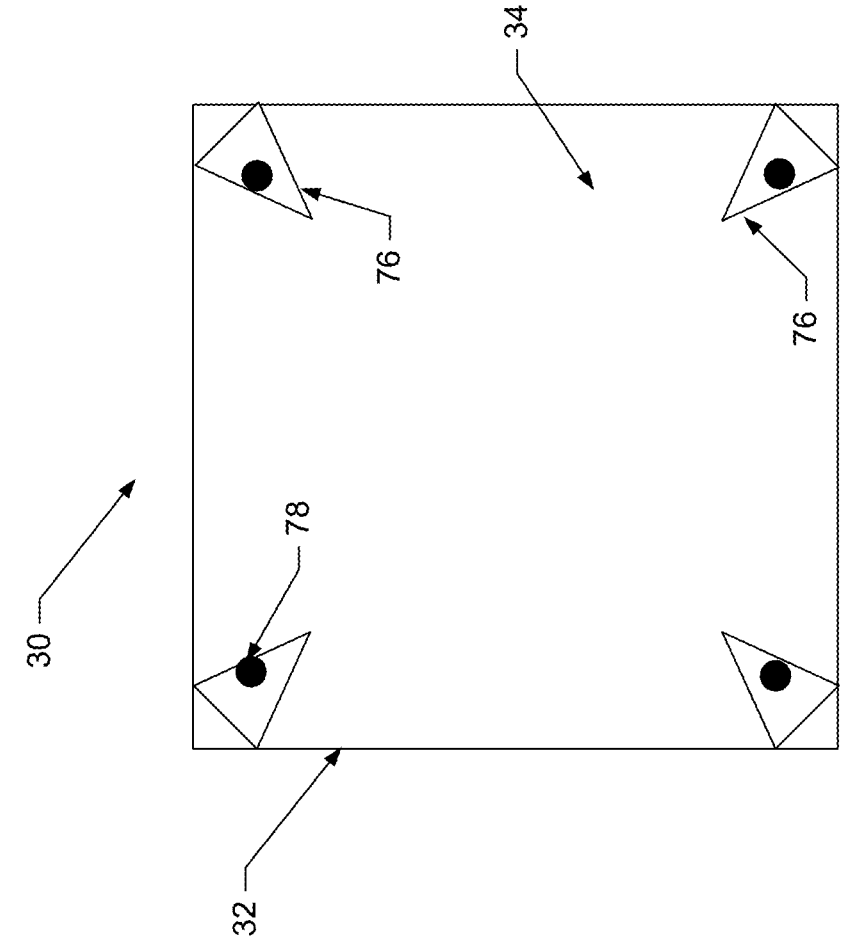


FIG. 10D

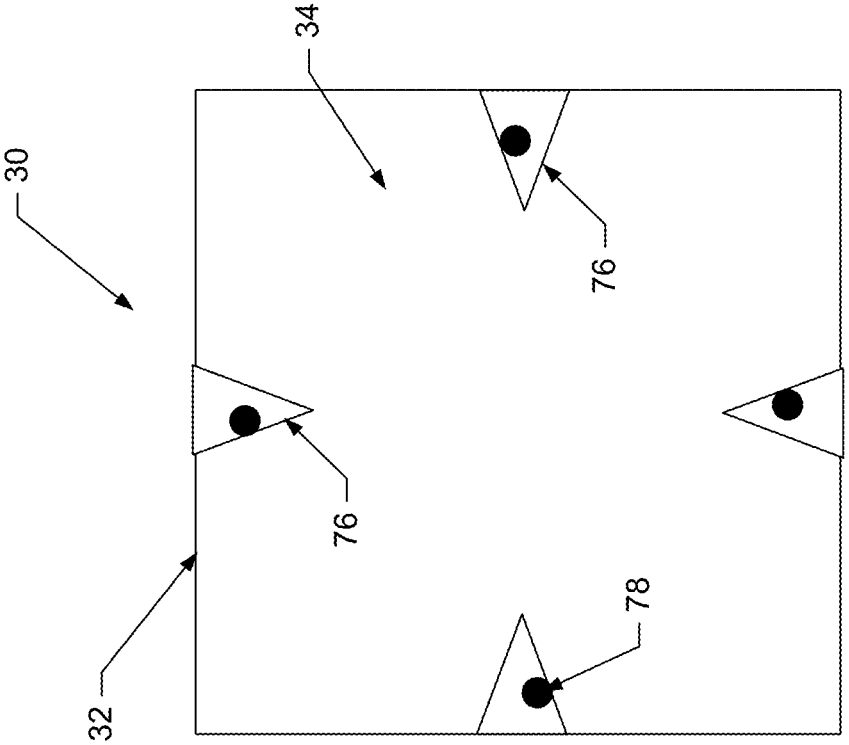


FIG. 10C

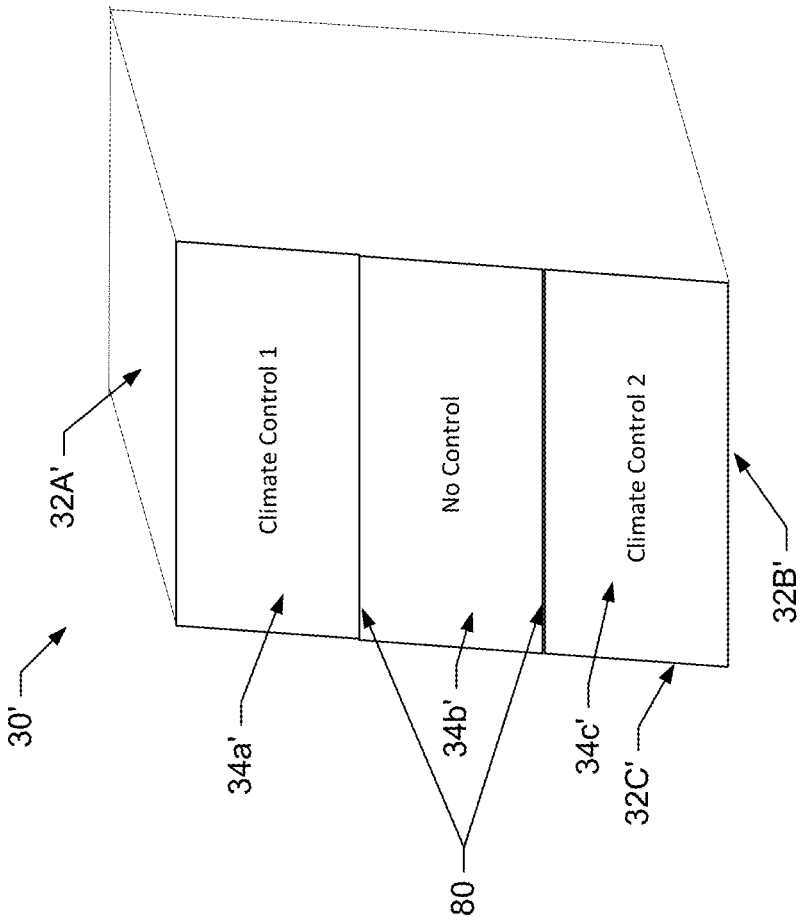

Climate Control 1
No Control
Climate Control 2
30'
32A'
32B'
32C'
34a'
34b'
34c'
80

FIG. 11

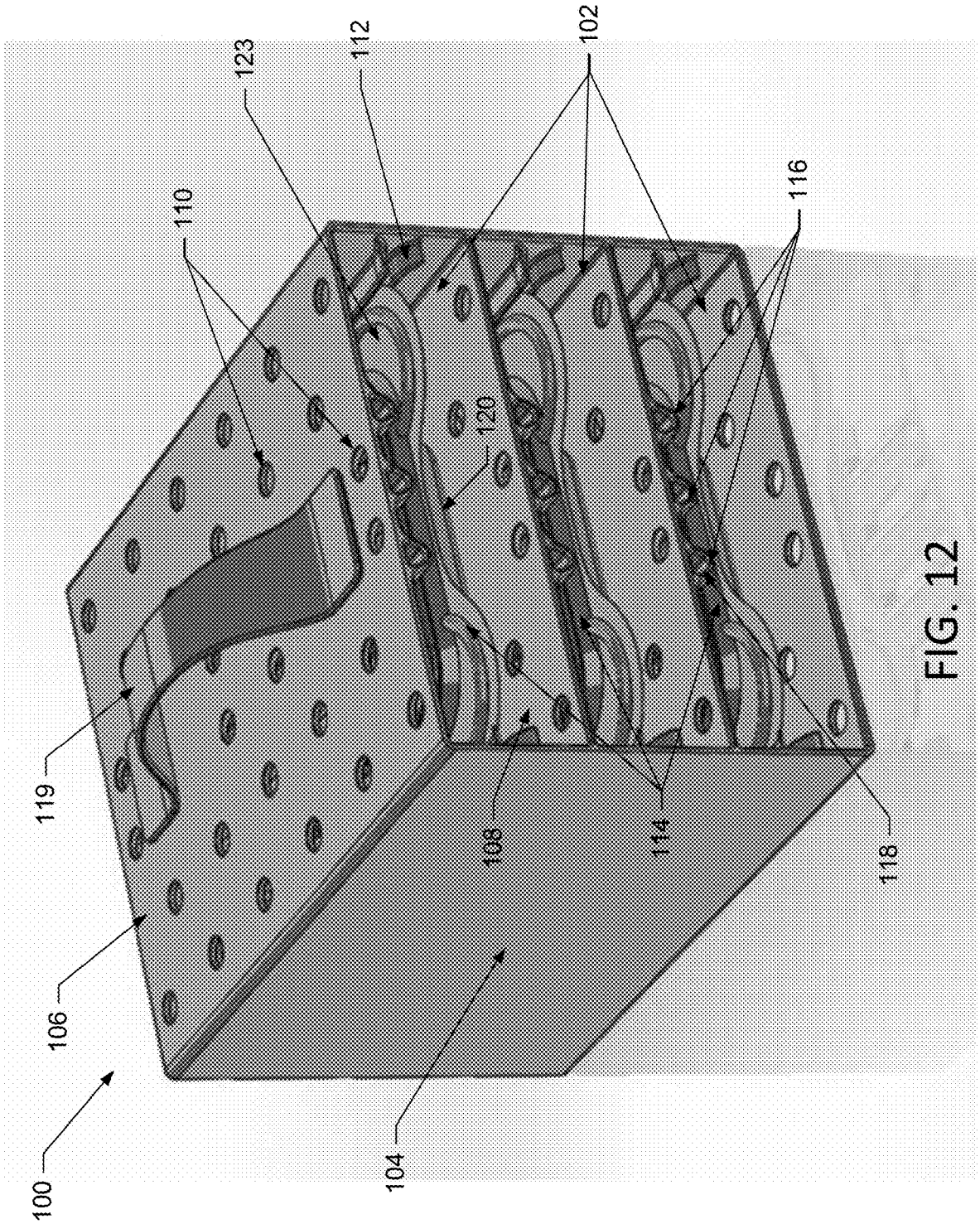


FIG. 12

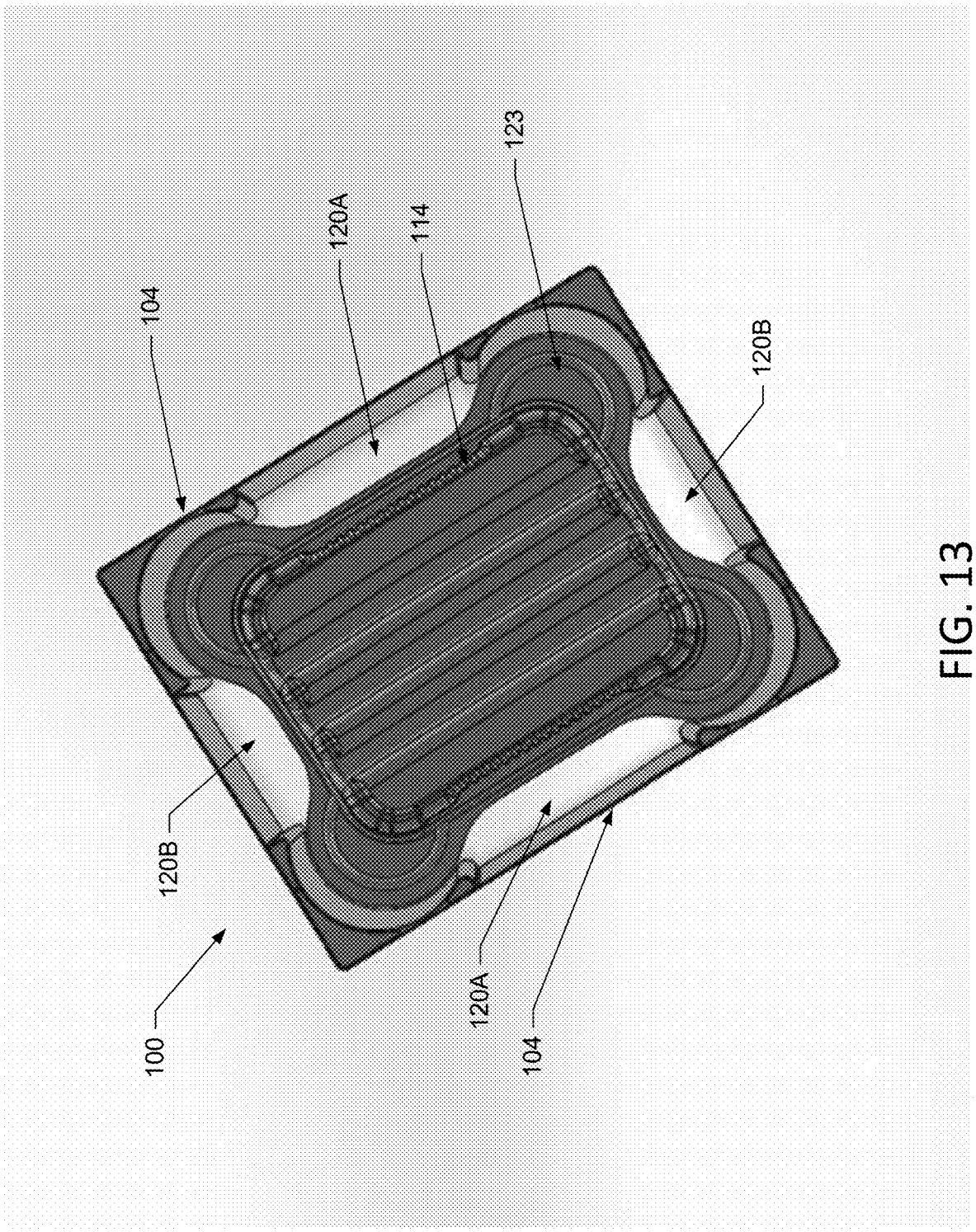


FIG. 13

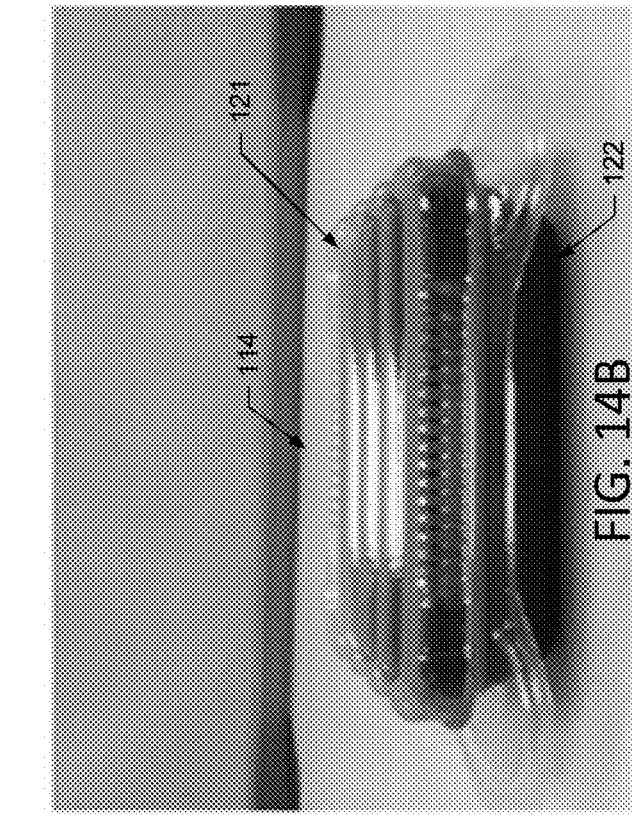


FIG. 14B

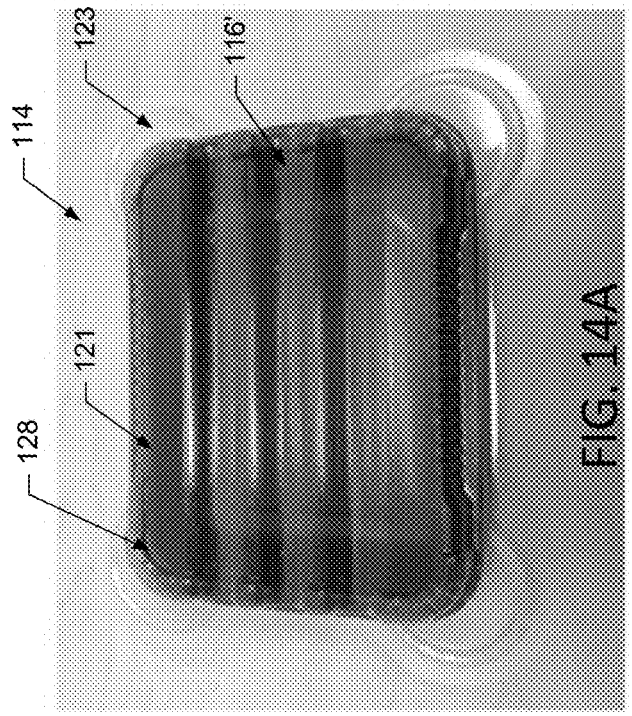


FIG. 14A

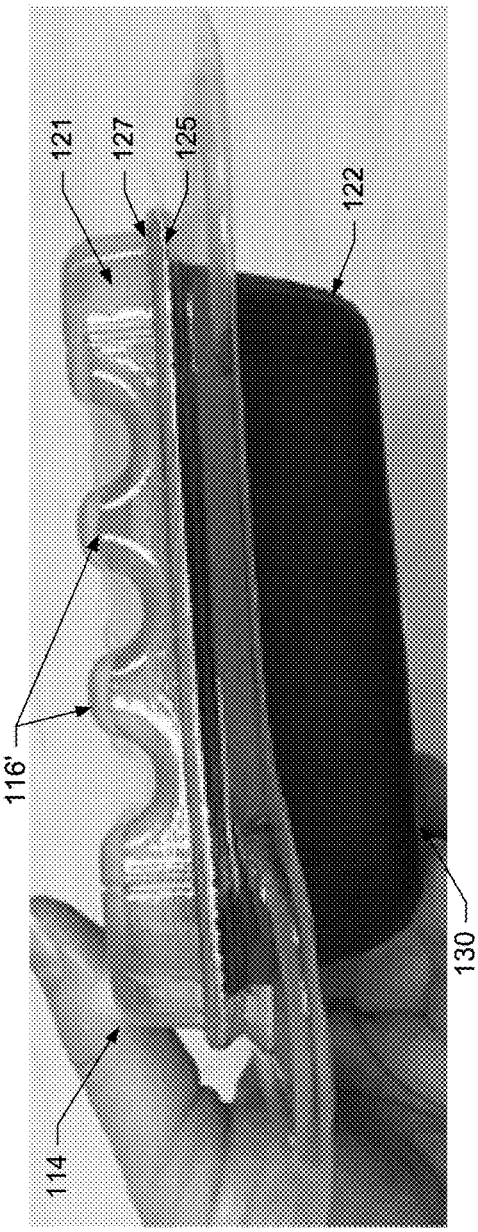


FIG. 14C

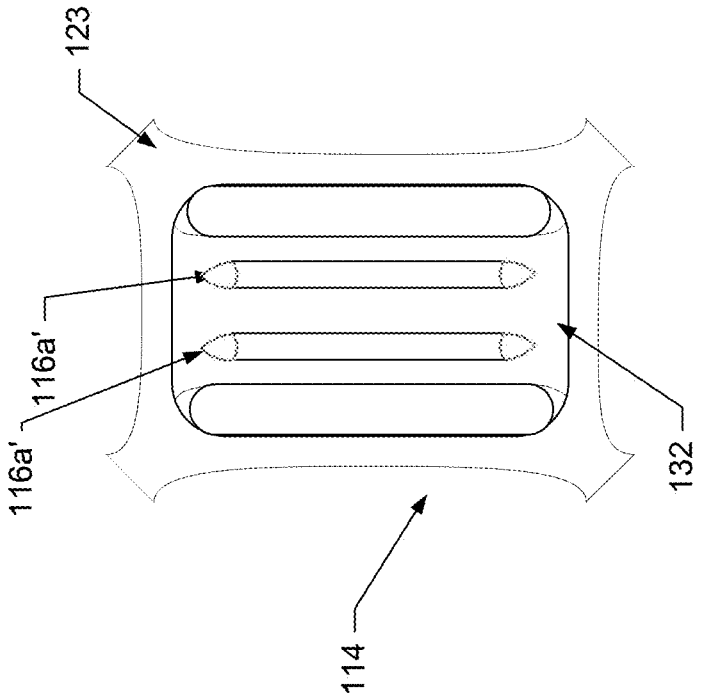


FIG. 14D

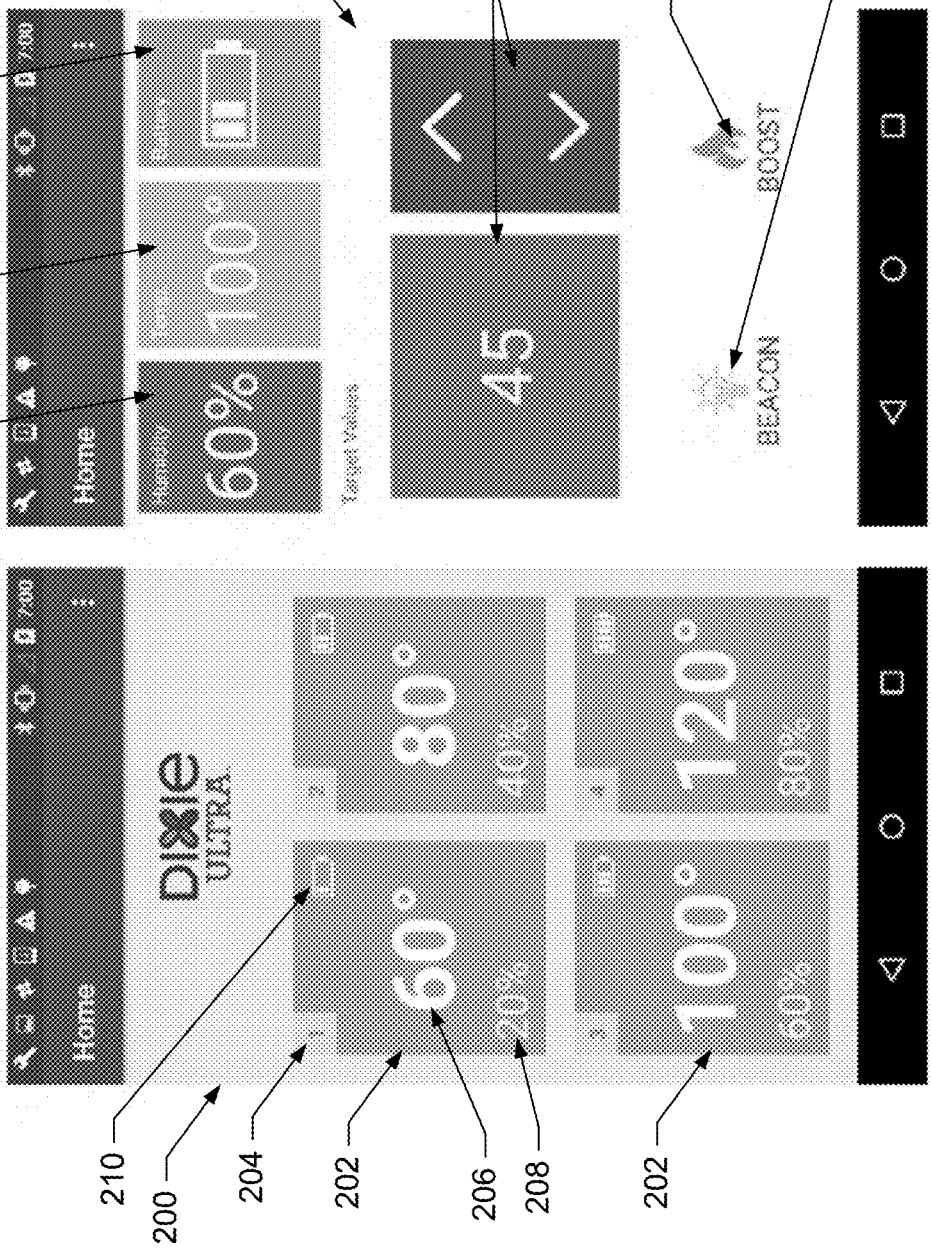


FIG. 15A

FIG. 15B

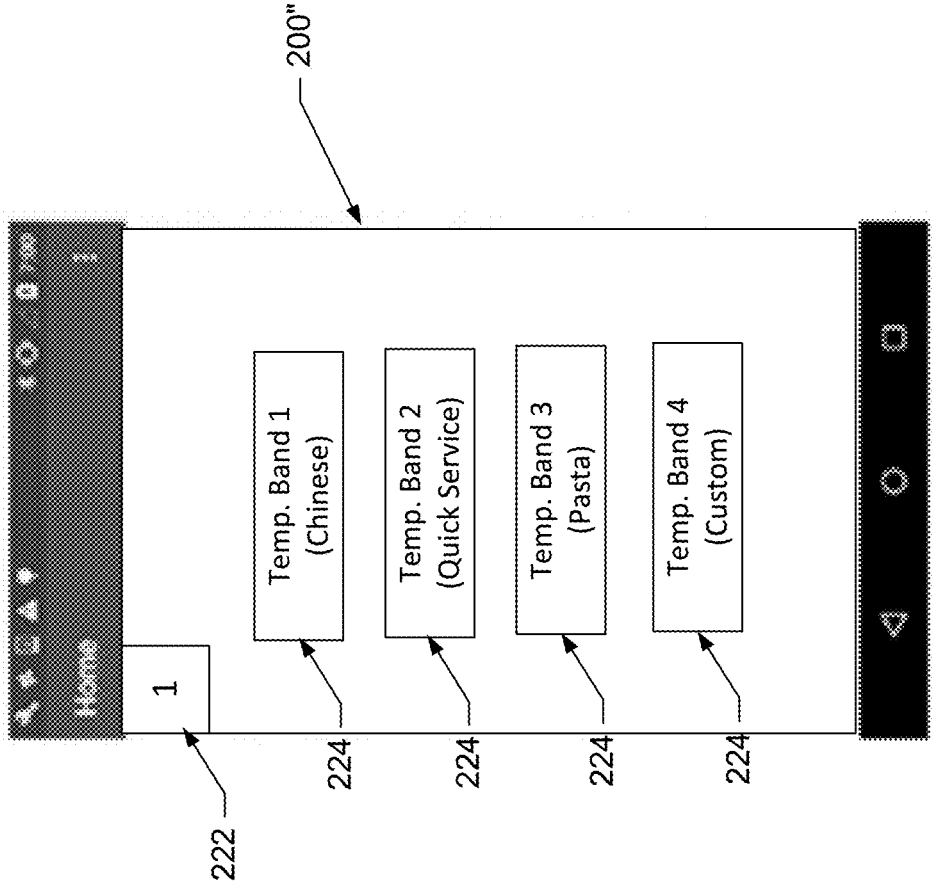

200"
Home
1
Temp. Band 1 (Chinese)
Temp. Band 2 (Quick Service)
Temp. Band 3 (Pasta)
Temp. Band 4 (Custom)
222
224
224
224
224

FIG. 15C

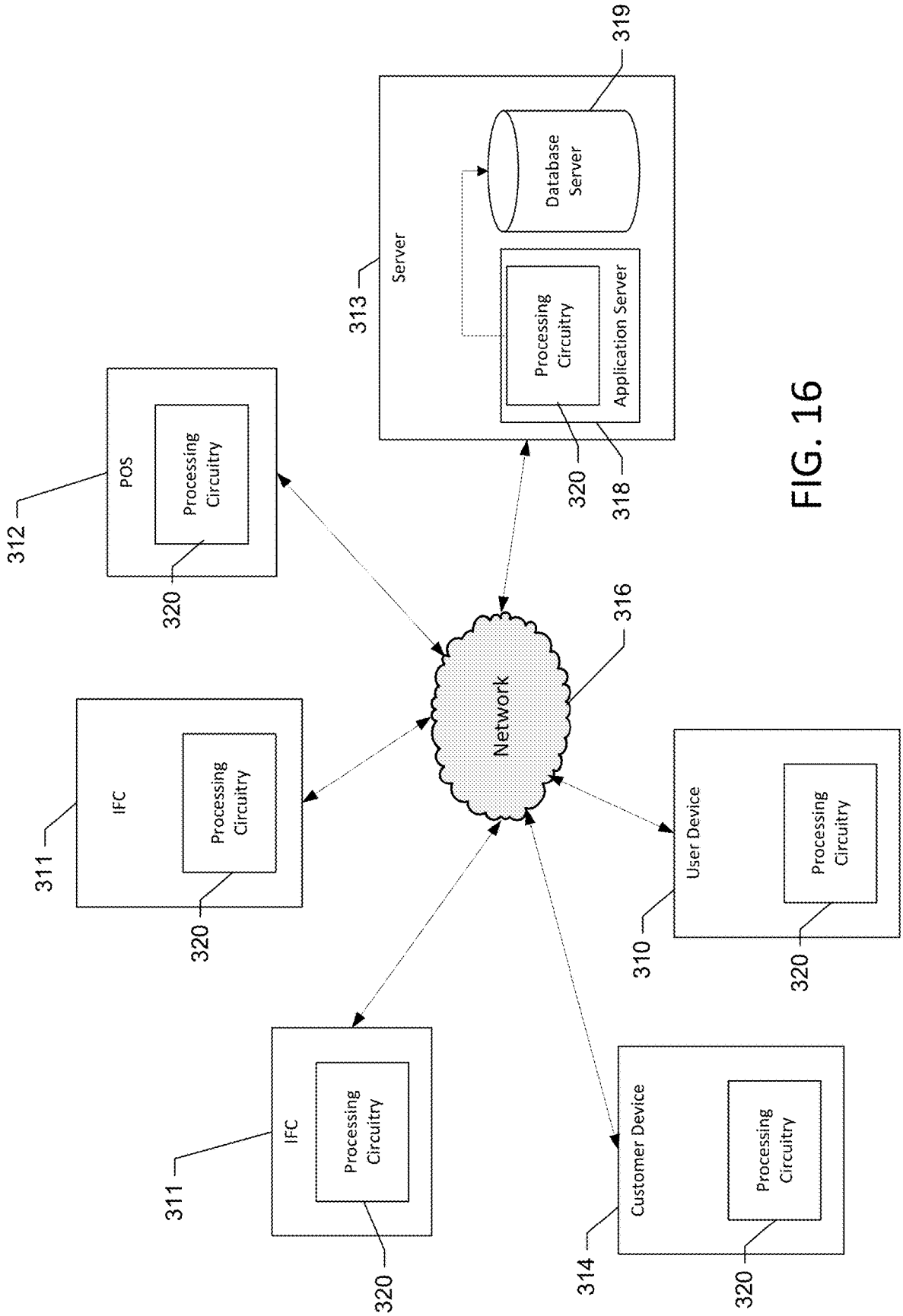

319
Database Server
Server
313
Processing Circuitry
Application Server
320
318
POS
Processing Circuitry
312
320
316
Network
IFC
Processing Circuitry
311
320
User Device
Processing Circuitry
310
320
IFC
Processing Circuitry
311
320
Customer Device
Processing Circuitry
314
320

FIG. 16

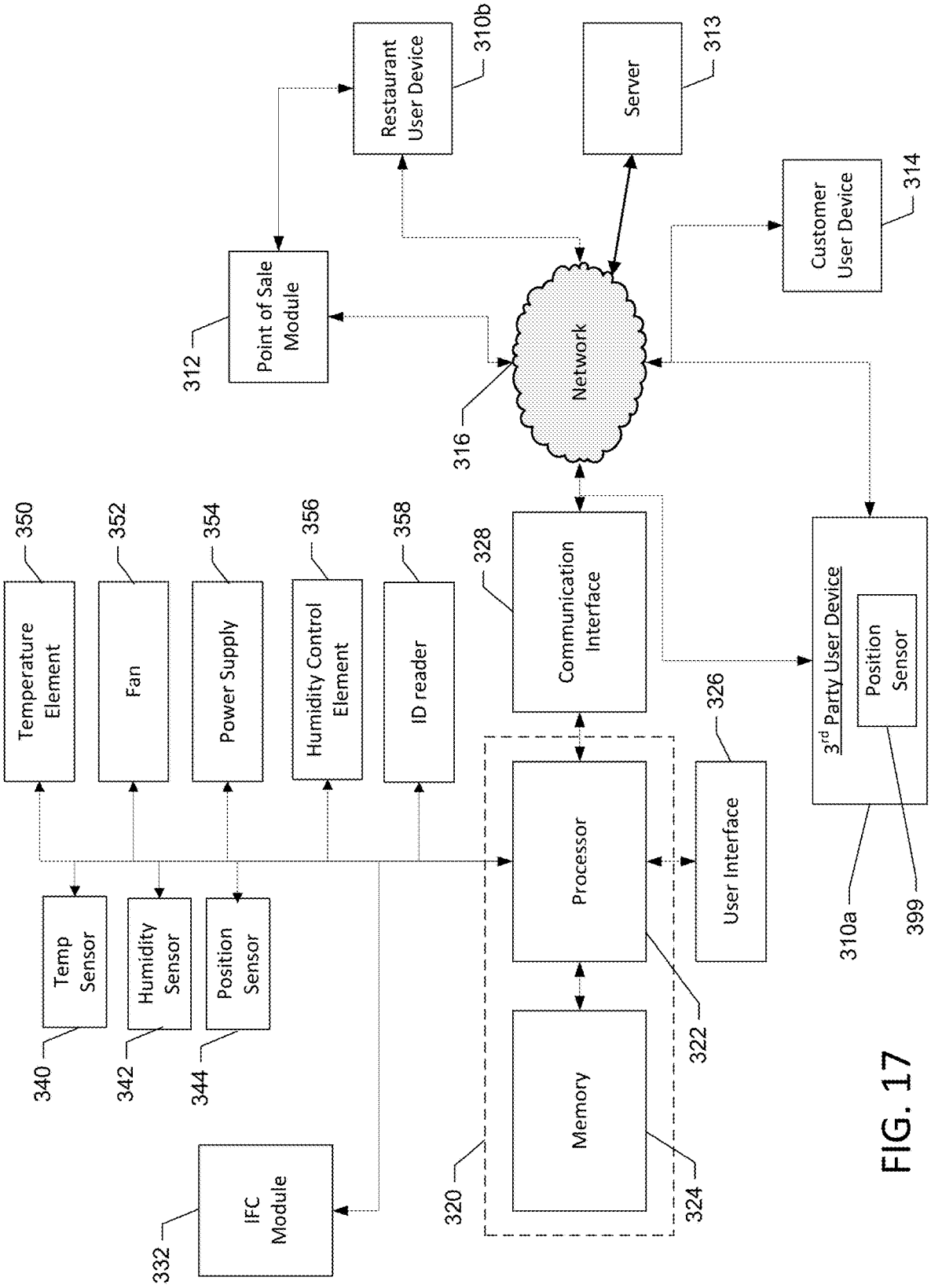

Restaurant User Device
310b
Server
313
Customer User Device
314
Point of Sale Module
312
Network
316
Temperature Element
350
Fan
352
Power Supply
354
Humidity Control Element
356
ID reader
358
Communication Interface
328
3rd Party User Device
Position Sensor
326
Processor
User Interface
Temp Sensor
340
Humidity Sensor
342
Position Sensor
344
IFC Module
332
320
Memory
324
322
310a
399

FIG. 17

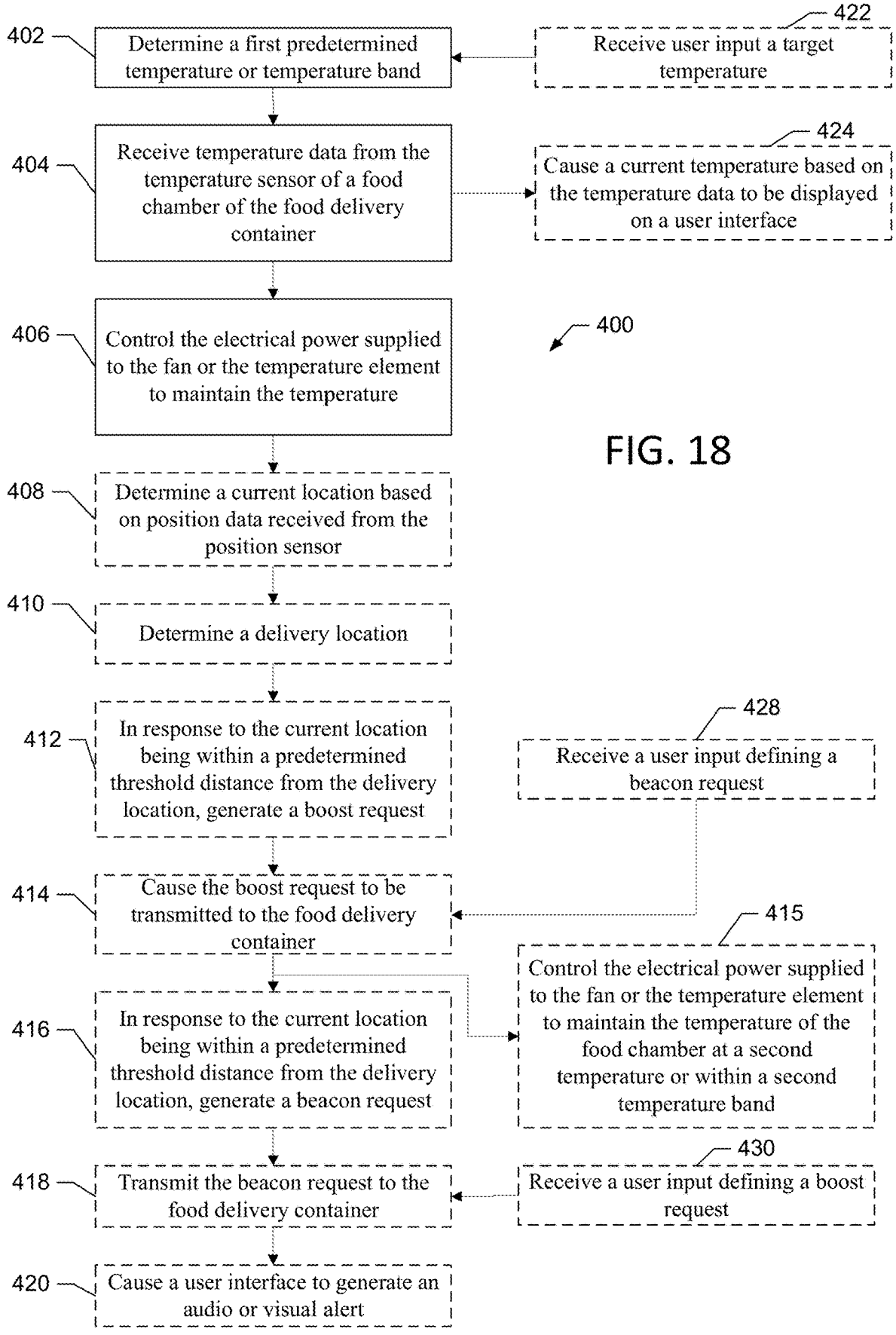

402
Determine a first predetermined temperature or temperature band
422
Receive user input a target temperature
404
Receive temperature data from the temperature sensor of a food chamber of the food delivery container
424
Cause a current temperature based on the temperature data to be displayed on a user interface
406
Control the electrical power supplied to the fan or the temperature element to maintain the temperature
400
408
Determine a current location based on position data received from the position sensor
410
Determine a delivery location
412
In response to the current location being within a predetermined threshold distance from the delivery location, generate a boost request
428
Receive a user input defining a beacon request
414
Cause the boost request to be transmitted to the food delivery container
415
Control the electrical power supplied to the fan or the temperature element to maintain the temperature of the food chamber at a second temperature or within a second temperature band
416
In response to the current location being within a predetermined threshold distance from the delivery location, generate a beacon request
430
Receive a user input defining a boost request
418
Transmit the beacon request to the food delivery container
420
Cause a user interface to generate an audio or visual alert

FIG. 18

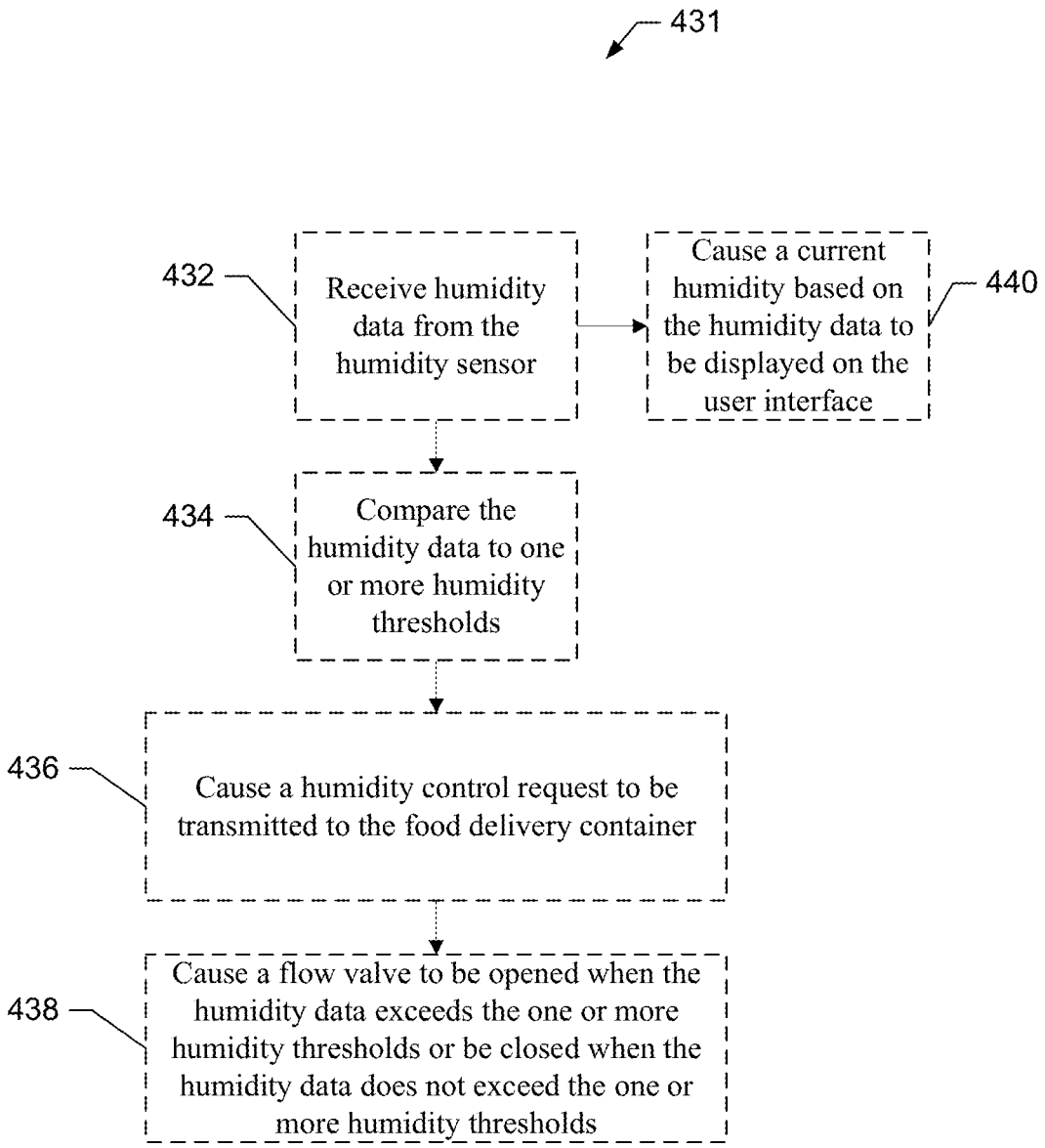

431
432
Receive humidity data from the humidity sensor
Cause a current humidity based on the humidity data to be displayed on the user interface
440
434
Compare the humidity data to one or more humidity thresholds
436
Cause a humidity control request to be transmitted to the food delivery container
438
Cause a flow valve to be opened when the humidity data exceeds the one or more humidity thresholds or be closed when the humidity data does not exceed the one or more humidity thresholds

FIG. 19

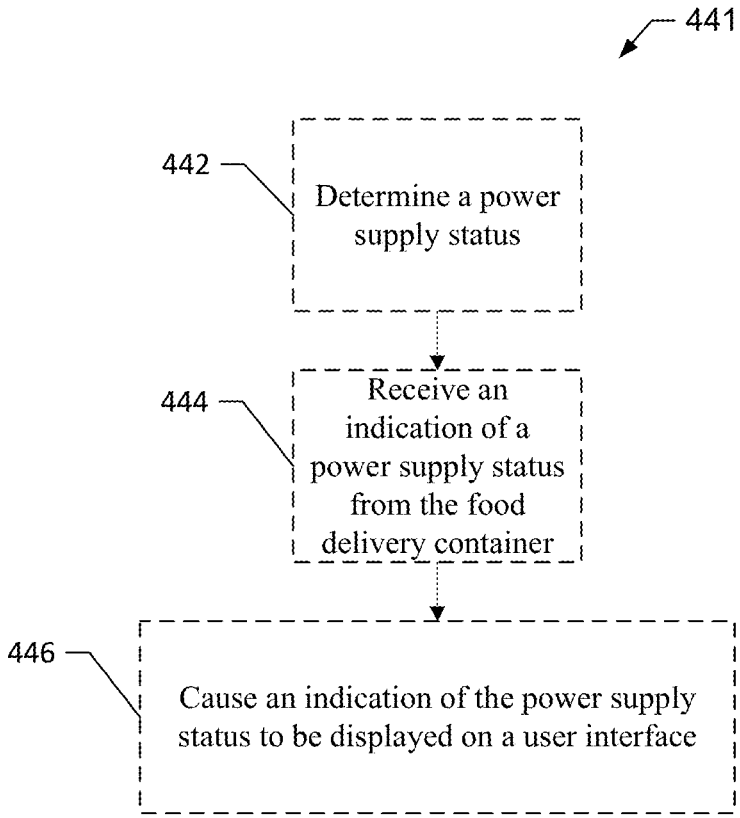

441
442
Determine a power supply status
444
Receive an indication of a power supply status from the food delivery container
446
Cause an indication of the power supply status to be displayed on a user interface

FIG. 20

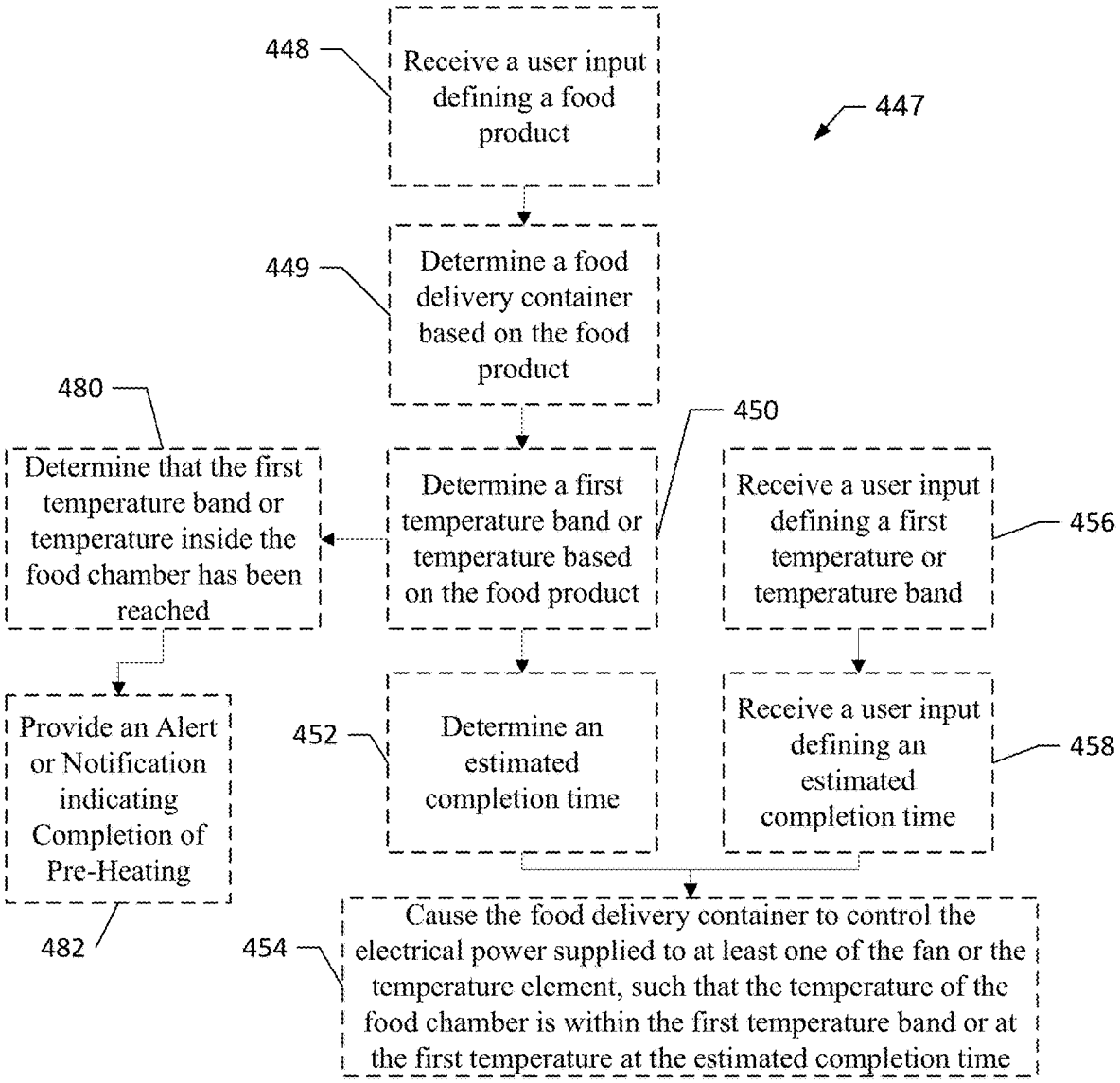

448
Receive a user input defining a food product
447
449
Determine a food delivery container based on the food product
480
450
Determine that the first temperature band or temperature inside the food chamber has been reached
Determine a first temperature band or temperature based on the food product
Receive a user input defining a first temperature or temperature band
456
Provide an Alert or Notification indicating Completion of Pre-Heating
452
Determine an estimated completion time
Receive a user input defining an estimated completion time
458
482
454
Cause the food delivery container to control the electrical power supplied to at least one of the fan or the temperature element, such that the temperature of the food chamber is within the first temperature band or at the first temperature at the estimated completion time

FIG. 21

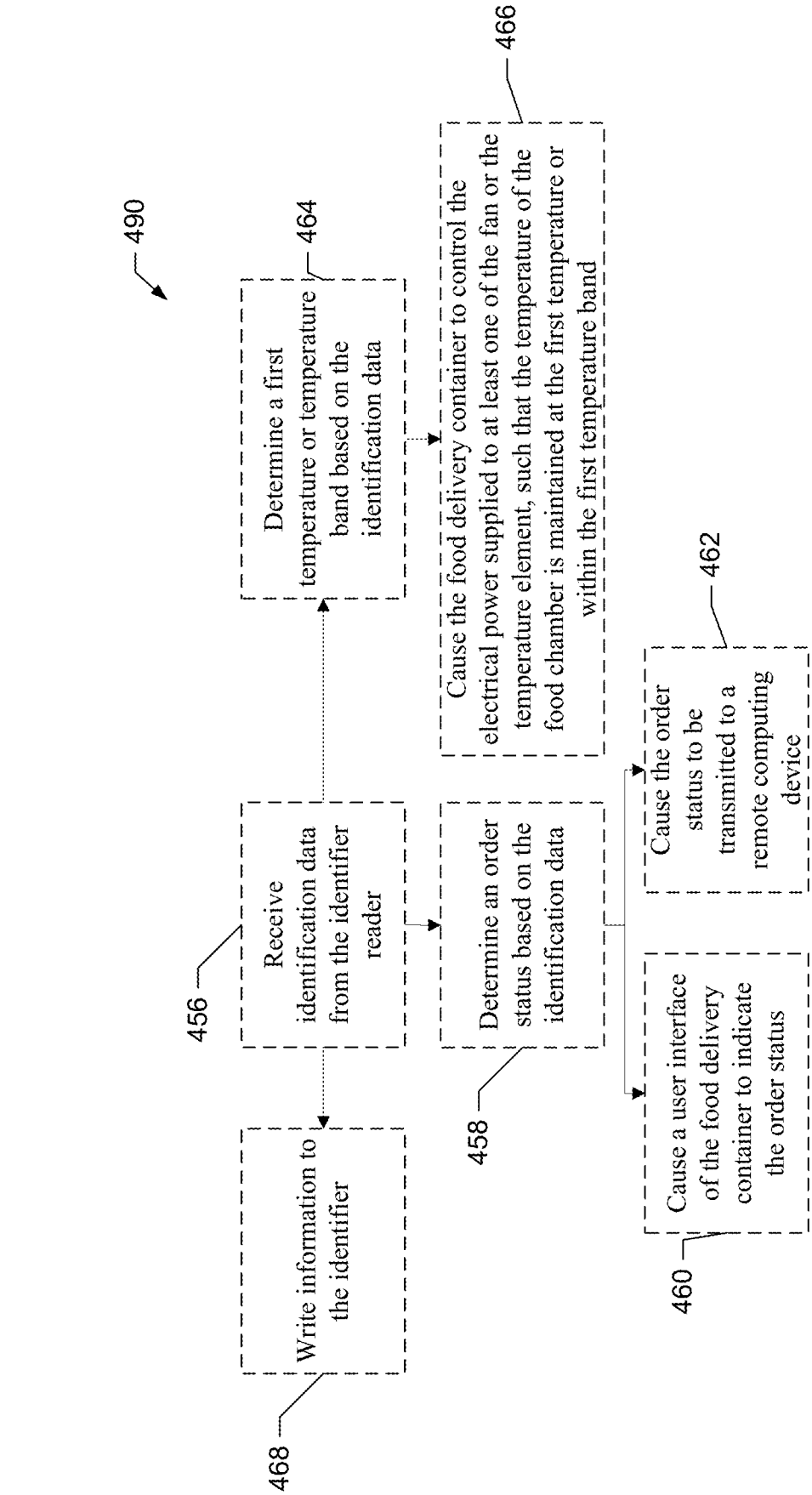

490
456
Receive identification data from the identifier reader
464
Determine a first temperature or temperature band based on the identification data
466
Cause the food delivery container to control the electrical power supplied to at least one of the fan or the temperature element, such that the temperature of the food chamber is maintained at the first temperature or within the first temperature band
458
Determine an order status based on the identification data
462
Cause the order status to be transmitted to a remote computing device
460
Cause a user interface of the food delivery container to indicate the order status
468
Write information to the identifier

FIG. 22

FOOD DELIVERY SYSTEMS, APPARATUSES, AND METHODS

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to U.S. Provisional Application No. 62/794,051, entitled "Food Delivery Systems, Apparatuses, and Methods", filed Jan. 18, 2019, which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

[0002] Insulated food containers (IFCs), such as delivery bags are typically used to transport food products from a restaurant or kitchen to a delivery location. IFCs are generally configured to limit the change in temperature of the food during the delivery. However, some IFCs may be subject to significant heat loss, such as due to long distance deliveries, delays in delivery, or delays in time of consumption. These heat losses may be particularly significant in cold climates. In addition to heat loss, some IFCs may be susceptible to moisture buildup, such as from steam escaping food packages contained therein. The increased moisture may cause undesirable effects on the food products.

SUMMARY OF THE INVENTION

[0003] The present invention generally relates to food containers and, more particularly, relates to food delivery systems, apparatuses, and corresponding methods.

[0004] Example embodiments of the present invention provide food delivery systems, apparatuses, and methods that create efficient and effective food delivery services. In some example embodiments, a food delivery system may be provided. The food delivery system may include an insulated food container (IFC) having a plurality of insulated walls forming a food chamber. The food chamber may be climate controlled by one or more climate control systems configured to maintain the temperature of the food chamber, such as in a specified temperature band. The climate control system may be positioned in one of the insulated walls and include an air flow pathway that includes a heating/cooling element disposed therein and a fan in communication with the food chamber through an inlet opening and at least one outlet opening. The fan may be configured to draw in air from the food chamber through the inlet opening and push air into the food chamber through the outlet opening such that air travels through the air flow pathway and over the heating/cooling element to circulate heated/cooled air within the food chamber.

[0005] In some example embodiments, a food package support is provided to receive one or more food packages. The food package support may include a plurality of flow holes to enable the heated/cooled air to circulate about the food packages. In some embodiments, the food packages themselves may include one or more concave edges that align with the flow holes of the food package support to maximize air flow about the food packages. In some embodiments, the food packages may be reusable, such as being made from reusable or washable material.

[0006] In some example embodiments, the system may be configured to manually or automatically control the temperature band of the IFC using a computing device, such as a smart phone, tablet, or point of sale (POS) device. In some example embodiments, a beacon request may be generated to cause a user interface of the IFC to indicate a selected IFC. In some example embodiments, a boost request may be generated to increase the temperature of the food chamber, such as just prior to (e.g., within 5 minutes of) delivery. The boost request and/or beacon request may be generated manually, such as by interaction with a user interface, or may be generated automatically, such as based on a proximity to a delivery location.

[0007] In addition to temperature control, some example embodiments, may include a humidity control element configured to control a moisture content of the volume of air in the food chamber. In an example embodiment, the IFC may be configured to maintain humidity at a predetermined humidity level or in a predetermined humidity band by controlling a flow valve that enables or prevents flow of air through the humidity control element. The humidity control element may reduce moisture build up from food product moisture escape, which may cause undesirable food textures.

[0008] In some example embodiments, a power supply of the climate control system may include a rechargeable power supply, such as rechargeable batteries or capacitors. The rechargeable batteries or capacitors may be recharged through a wireless charging element, such as an induction charging coil, or through a wired plug, such as a vehicle DC power plug or AC wall plug.

[0009] In some example embodiments, the POS may be integrated into the food delivery system. The system may receive food product information and determine a temperature band for the IFC, for example different temperature hands may be appropriated for soup and pizza. Additionally, the food product information may be used to determine an estimated completion time (e.g., when the food will be ready for insertion into the food delivery container). Accordingly, the food delivery system may cause the IFC to pre-heat to the selected temperature band at the estimated completion time. In some example embodiments, a pre-heat status or beacon request may be generated (such as by providing an alert or notification) to indicate the IFC that is being pre-heated and/or the status of pre-heating the IFC (e.g., pre-heating is complete). In some example embodiments, the food delivery system may also determine an IFC based on a food size of the food products.

[0010] In some example embodiments, the food delivery system may be remotely disabled, such that the climate control system does not provide heated air to the food chamber. For example, the climate control system of individual IFCs or groups of IFCs may be disabled when lost or stolen.

[0011] In some example embodiments, an identifier reader may be positioned within the food delivery container and configured to identify one or more food packages placed within the food delivery container. In some embodiments, the data read by the identifier reader may identify the food package and/or provide instructions regarding how to operate various aspects of the food delivery container.

[0012] In an example embodiment, a food delivery container is provided. The food delivery container comprises a plurality of insulated walls that form a food chamber. At least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food delivery container includes a climate control system positioned within one of the plurality of insulated walls. The climate

control system comprises an air flow pathway; a heating element positioned within the air flow pathway; and a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the heating element to circulate heated air within the food delivery container. The food delivery container includes a power supply configured to supply electrical power to the fan and the heating element.

[0013] In some embodiments, the food delivery container comprises a temperature sensor configured to measure a temperature of the food chamber; a processor; and a memory. The memory includes computer program code configured to cause the processor to: receive temperature data from the temperature sensor; and control the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber either at a first predetermined temperature or within a first predetermined temperature band.

[0014] In some embodiments, the food delivery container further includes a position sensor. The computer program code is further configured to cause the processor to: determine a current location based on position data received from the position sensor; determine a delivery location; compare the current location to the delivery location; and, in response to determining that the current location is within a predetermined threshold distance from the delivery location, control the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber either at a second predetermined temperature or within a second predetermined temperature band. The second predetermined temperature band is higher than the first predetermined temperature band or the second predetermined temperature is higher than the first predetermined temperature.

[0015] In some embodiments, the computer program code is further configured to cause the processor to: receive a boost request from a remote computing device; and control the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber either at a second predetermined temperature or within a second predetermined temperature band. The second predetermined temperature band is higher than the first predetermined temperature band or the second predetermined temperature is higher than the first predetermined temperature.

[0016] In some embodiments, the computer program code is further configured to cause the processor to: receive a user input defining a food product; determine the first predetermined temperature or the first predetermined temperature band based on the food product; control the electrical power supplied to at least one of the fan or the heating element such that the temperature of the food chamber is either brought to or maintained at the first predetermined temperature or within the first predetermined temperature band; and cause, in response to determining that the temperature of the food chamber has reached the first predetermined temperature or the first predetermined temperature band, an alert or notification to indicate that the temperature of the food chamber has reached the first predetermined temperature or the first predetermined temperature band.

[0017] In some embodiments, the computer program code is further configured to cause the processor to: receive a user input defining the first predetermined temperature or the first predetermined temperature hand; determine an estimated completion time corresponding to when the food product will be ready for placement into the food chamber; and control the electrical power supplied to at least one of the fan or the heating element such that the temperature of the food chamber is either at the first predetermined temperature or within the first predetermined temperature band at the estimated completion time.

[0018] In some embodiments, the food delivery container further comprises a position sensor. The computer program code is further configured to cause the processor to determine a current location based on position data received from the position sensor. In some embodiments, the computer program code is further configured to cause the processor to: determine a delivery location; compare the current location to the delivery location; and, in response to determining that the current location is within a predetermined threshold distance from the delivery location, cause a user interface of the food delivery container to generate an audio or visual alert.

[0019] In some embodiments, the food delivery container further comprises a processor; and a memory including computer program code configured to cause the processor to: receive a beacon request from a remote computing device; and cause a user interface of the food delivery container to generate an audio or visual alert.

[0020] In some embodiments, the power supply comprises a rechargeable battery or capacitor that is capable of being recharged and providing electrical power. In some embodiments, the food delivery container further comprises a wireless charging element configured to receive an inductive charge that charges the rechargeable battery or capacitor. In some embodiments, the food delivery container further comprises a wired power supply configured to receive AC or DC power from a power source and charge the rechargeable battery or capacitor. In some embodiments, the power source may be either a vehicle DC power socket or an AC wall socket.

[0021] In some embodiments, the food delivery container further comprises a removable liner disposed within the food chamber and configured to contain fluid within the food chamber.

[0022] In some embodiments, the food delivery container further comprises at least one heat conductor configured to disperse heat generated by the heating element, rechargeable battery, or capacitor.

[0023] In some embodiments, the heating element comprises a resistive heating coil.

[0024] In some embodiments, the food delivery container further comprises one or more silicone heating pads disposed on an inner surface of one or more of the plurality of insulated walls. The power supply is further configured to supply electrical power to the one or more silicone heating pads. In some embodiments, the one or more silicone heating pads comprise a first heating pad and a second heating pad, wherein the first heating pad is disposed proximate to a first insulated wall and the second heating pad is disposed proximate to a second insulated wall opposite the first insulated wall. In some embodiments, the air flow pathway further comprises a second outlet positioned within the one of the plurality of insulated walls. The one of the

plurality of insulated walls defines a first edge and an opposite second edge, and the first outlet is disposed proximate to the first edge and the second outlet is disposed proximate to the second edge. In some embodiments, the one of the plurality of insulated walls with the climate control systems comprises a top wall of the food chamber.

[0025] In some embodiments, the food delivery container further comprises a humidity control element configured to remove or add humidity to a volume of air within the food chamber to maintain either a predetermined humidity level or a predetermined humidity band. In some embodiments, the humidity control element comprises an absorbent cloth, desiccant, rechargeable desiccant, or mixed salts. In some embodiments, the humidity control element comprises a flow valve configured to limit air flow across the humidity control element when the flow valve is in a shut position. The food delivery container further comprises: a humidity sensor configured to measure the humidity of the volume of air within the food chamber; a processor; and a memory. The memory includes computer program code configured to cause the processor to: receive humidity data from the humidity sensor; compare the humidity data to one or more humidity thresholds; and cause the flow valve to be opened when the humidity data exceeds the one or more humidity thresholds or to be closed when the humidity data does not exceed the one or more humidity thresholds.

[0026] In some embodiments, the food delivery container further comprises a Food package support configured to be inserted within the food chamber. The food package support comprises a plurality of food package receptacles defined by a plurality of receptacle walls. The plurality of receptacle walls comprises two side walls disposed on opposite sides of the food package support, an upper wall, and lower wall for each of the plurality of food package receptacles. The upper walls and lower walls of the plurality of food package receptacles comprise at least one flow hole enabling air flow through the food package support. In some embodiments, the at least one flow hole is configured to be aligned with the first air outlet opening of the one of the plurality of insulated walls defining the food chamber. In some embodiments, the food package support further comprises a plurality of pinch slots, wherein the plurality of pinch slots are configured to engage a food package to limit opening of the food package when inserted into one of the plurality of food package receptacles. In some embodiments, the upper wall or the lower wall of each of the plurality of food package receptacles comprises one or more ribs configured to engage a complimentary one or more ribs disposed on a bottom or a top of a food package. In some embodiments, the one or more ribs further comprises at least two rib flow holes enabling air flow through the one or more ribs. In some embodiments, the at least one flow hole comprises a plurality of flow holes configured to enable air flow between the plurality of food package receptacles, and wherein the plurality of flow holes are disposed in the upper walls and lower walls of each of the plurality of food package receptacles such that air flows around food packages that each have at least one concave edge.

[0027] In some embodiments, the food delivery container further comprises a processor and a memory including computer program code configured to cause the processor to: determine a power supply status; and cause an indication of the power supply status to be displayed on a user interface.

[0028] In some embodiments, the fan and the heating element are disposed proximate to a top insulated wall and the power supply is disposed proximate to a bottom insulated wall.

[0029] In some embodiments, the food delivery container further comprises an identifier reader configured to read a food package identifier associated with one or more food packages placed within the food chamber; a processor; and a memory including computer program code configured to cause the processor to receive identification data from the identifier reader. In some embodiments, the computer program code is further configured to cause the processor to: determine a first predetermined temperature or a first predetermined temperature band based on the identification data; and cause the food delivery device to control the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber either at a first predetermined temperature or within a first predetermined temperature hand. In some embodiments, the computer program code is further configured to cause the processor to determine an order status based on the identification data by comparing the identification data with a planned order, wherein the planned order includes required meal components corresponding to a customer order scheduled for delivery using the food delivery container. In some embodiments, the computer program code is further configured to cause the processor to cause a user interface associated with the food delivery container to indicate the order status. In some embodiments, the computer program code is further configured to cause the processor to cause the order status to be transmitted to a remote computing device. In some embodiments, the identifier reader comprises one of a barcode reader, a QR code reader, a character reader, an RFID reader, or an energy quality reader.

[0030] In some embodiments, the food delivery container further comprises one or more wall projections extending from at least one of the plurality of insulated walls into the food chamber, wherein the one or more wall projections are configured to enable complementary food packaging to be placed into the food chamber and limit or prevent non-complementary food packaging from being placed into the food chamber. In some embodiments, the one or more wall projections are configured to channel heated air through the respective one or more wall projections. In some embodiments, the one or more wall projections are aligned with the first inlet opening or the first outlet opening. In some embodiments, the one or more wall projections comprise one or more flow holes configured to enable air flow from the wall projection into the food chamber.

[0031] In another example embodiment, a system is provided. The system comprises a food delivery container comprising a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food delivery container further includes a temperature sensor configured to measure a temperature of the food chamber and a climate control system positioned within one of the plurality of insulated walls. The climate control system comprises an air flow pathway; a heating element positioned within the air flow pathway; and a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in

air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the heating element to circulate heated air within the food delivery container. The food delivery container further comprises a power supply configured to supply electrical power to the fan and the heating element. The system further comprises an application module stored on a computing device, wherein the computing device comprises a processor and a memory including computer program code configured to cause the processor to: receive temperature data from the temperature sensor; and cause the food delivery container to control the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber at a first predetermined temperature or within a first predetermined temperature band.

[0032] In some embodiments, the computing device comprises a computing device that is separate from the food delivery container.

[0033] In some embodiments, the computing device comprises a point of sale computing device.

[0034] In some embodiments, the computing device comprises a mobile computing device.

[0035] In some embodiments, the system further comprises a position sensor positioned relative to the food delivery container and configured to determine the current location of the food delivery container, and the computer program code is further configured to cause the processor to determine a current location based on position data received from the position sensor. In some embodiments, the computer program code is further configured to cause the processor to: determine a delivery location; compare the current location to the delivery location; and, in response to determining that the current location is within a predetermined threshold distance from the delivery location, cause a boost request to be transmitted to the food delivery container. The boost request causes the food delivery container to control the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber at a second predetermined temperature or within a second predetermined temperature hand. The second predetermined temperature is higher than the first predetermined temperature or the second predetermined temperature band is higher than the first predetermined temperature band. In some embodiments, the computer program code is further configured to cause the processor to: determine a delivery location; compare the current location to the delivery location; and, in response to determining that the current location is within a predetermined threshold distance from the delivery location, cause a beacon request to be transmitted to the food delivery container. The beacon request causes the food delivery container to cause a user interface to generate an audio or visual alert.

[0036] In yet another example embodiment, a method for controlling a food delivery container is provided. The method comprises receiving temperature data from a temperature sensor configured to measure a temperature of a food chamber of the food delivery container. The food delivery container comprises a plurality of insulated walls forming the food chamber. At least one of the insulated walls is moveable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food delivery container further comprises a climate control system positioned within one of the plurality of insulated walls. The climate control system comprises an air flow pathway, a heating element positioned within the air flow pathway, and a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the heating element to circulate heated air within the food delivery container. The food delivery container further includes a power supply configured to supply electrical power to the fan and heating element. The method comprises controlling the electrical power supplied to at least one of the fan or the heating element to maintain the temperature of the food chamber at a first predetermined temperature or within a first predetermined temperature band.

[0037] In yet another example embodiment, a food package support for a food chamber of a food delivery container is provided. The food package support comprises a plurality of food package receptacles defined by a plurality of receptacle walls. The plurality of receptacle walls comprises two side walls disposed on opposite sides of the food package support, an upper wall, and a lower wall for each of the plurality of food package receptacles. The upper walls and the lower walls of the plurality of food package receptacles comprise a plurality of flow holes that enable heated air flow through the food chamber. When the food package support is inserted into the food chamber, a first one of the plurality of flow holes is configured to align with a first air outlet of an air flow pathway of a climate control system.

[0038] In some embodiments, the air flow pathway of the climate control system further comprises a second air outlet opening. When the food package support is inserted into the food chamber, a second one of the plurality of flow holes is configured to align with the second air outlet of the air flow pathway.

[0039] In yet another example embodiment, a food package is provided. The food package comprises a food receiving portion comprising a first mating surface about a periphery of the food receiving portion; a lid comprising a second mating surface that aligns with and interacts with the first mating surface of the food receiving portion when the food package is closed; and a plurality of package projections extending from each corner of one of the food receiving portion or the lid so as to define flow pathways between consecutive package projections to enable heated air flow around the food package.

[0040] In some embodiments, the food package further comprises one or more ribs disposed on the food receiving portion or the lid. The one or more ribs are configured to engage a complementary one or more ribs disposed in a food package support.

[0041] In some embodiments, the food package further comprises a recess or projection disposed on the food receiving portion configured to engage a complementary projection or recess in the lid.

[0042] In yet another example embodiment, a system is provided. The system comprises a food delivery container comprising a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food

chamber. The food delivery container further includes a climate control system positioned within one of the plurality of insulated walls. The climate control system comprises an air flow pathway; a heating element positioned within the air flow pathway; a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the heating element to circulate heated air within the food delivery container. The food delivery container further includes a power supply configured to supply electrical power to the fan and the heating element. The system further includes a food package support comprising: a plurality of food package receptacles defined by a plurality of receptacle walls. The plurality of receptacle walls comprises two side walls disposed on opposite sides of the food package support, an upper wall, and a lower wall for each of the plurality of food package receptacles. The upper wall and the lower walls of the plurality of food package receptacles comprise a plurality of flow holes such that when the food package support is inserted into the food delivery container the plurality of flow holes enable heated air flow through the food chamber.

[0043] In yet another example embodiment, a system is provided. The system comprises a plurality of food delivery containers. Each of the food delivery containers comprises a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The system further comprises a user interface and an application module stored on a computing device. The computing device comprises a processor; and a memory including computer program code configured to cause the processor to: determine a delivery location corresponding to one of the plurality of food delivery containers; determine a current location corresponding to the one of the plurality of food delivery containers; compare the current location to the delivery location; and, in response to determining that the current location is within a predetermined threshold distance from the delivery location, cause a beacon request to be transmitted to the one of the plurality of food delivery containers to cause the user interface of the one of the plurality of food delivery containers to generate an audio or visual alert to enable audio or visual determination as to which of the plurality of food delivery containers corresponds to the delivery location.

[0044] In yet another example embodiment, a system is provided. The system comprises a plurality of food delivery containers. Each of the plurality of food delivery containers comprises a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The system further comprises a user interface and a point of sale (POS) device positioned remotely from the plurality of food delivery containers. The POS device comprises a POS processor and a POS memory including computer program code configured to cause the POS processor to receive a user input defining a food product. The system further comprises an application module configured to receive an indication of the food product and generate a request for a first one of the plurality of food delivery containers to cause the user interface of the first one of the plurality of food delivery containers to generate an audio or visual alert.

[0045] In some embodiments, the computer program code is further configured to cause the processor to determine the first one of the plurality of food delivery containers based on a food size associated with the food product.

[0046] In some embodiments, the first one of the plurality of food delivery containers further comprises a climate control system configured to maintain a temperature or a temperature band within the food chamber. The application module is further configured to determine a first predetermined temperature or a first predetermined temperature band based on the food product; and cause the first one of the plurality of food delivery containers to heat the food chamber to the first predetermined temperature or within the first predetermined temperature hand. In some embodiments, the application module is further configured to: determine an estimated completion time for the food product; and cause the first one of the plurality of food delivery containers to heat the food chamber to the first predetermined temperature or within the first predetermined temperature band before or at the estimated completion time.

[0047] In yet another example embodiment, a food delivery container is provided. The food delivery container comprises a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food delivery container further includes an identifier reader configured to read a food package identifier associated with one or more food packages placed within the food chamber. The food delivery container further comprises a processor and a memory including computer program code configured to cause the processor to: receive identification data from the identifier reader; and determine an order status based on the identification data.

[0048] In some embodiments, the identifier reader comprises one of a barcode reader, a QR code reader, a character reader, or an RFID reader.

[0049] In some embodiments, the computer program code is further configured to cause the processor to cause a user interface associated with the food delivery container to indicate the order status.

[0050] In some embodiments, the computer program code is further configured to cause the processor to cause the order status to be transmitted to a remote computing device.

[0051] In yet another example embodiment, a food delivery container is provided. The food delivery container comprises a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food delivery container further includes a climate control system positioned within one of the plurality of insulated walls. The climate control system comprises an air flow pathway; a cooling element positioned within the air flow pathway; and a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through

the air flow pathway and over the cooling element to circulate cooled air within the food delivery container. The food delivery container further includes a power supply configured to supply electrical power to the fan and the cooling element.

[0052] In yet another example embodiment, a food delivery container is provided. The food delivery container comprises a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food delivery container further includes a climate control system positioned within one of the plurality of insulated walls. The climate control system comprises: an air flow pathway; a temperature element positioned within the air flow pathway; and a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the temperature element to circulate heated or cooled air within the food delivery container. The food delivery container further includes a power supply configured to supply electrical power to the fan and the temperature element.

[0053] In some embodiments, the temperature element comprises a thermoelectric generator.

[0054] In some embodiments, the temperature element comprises a Peltier plate.

[0055] In some embodiments, the food delivery container further comprises a temperature sensor configured to measure a temperature of the food chamber; a processor; and a memory including computer program code configured to cause the processor to: receive temperature data from the temperature sensor; and control the electrical power supplied to at least one of the fan or the temperature element to maintain the temperature of the food chamber either at a first predetermined temperature or within a first predetermined temperature band.

[0056] In yet another example embodiment, a food delivery container is provided. The food delivery container comprises a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. The food chamber comprises a first compartment and a second compartment. The food delivery container further includes a climate control system positioned within one of the plurality of insulated walls. The climate control system comprises a cool air flow pathway and a heated air flow pathway; a cooling element positioned within the cool air flow pathway; a heating element position within the heated air flow pathway; a first fan; and a second fan. The first fan is in air flow communication with the first compartment of the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls. The first fan is configured to draw in air from the first compartment of the food chamber through the first inlet opening and push air into the first compartment of the food chamber through the first outlet opening such that air travels through the cool air flow pathway and over the cooling element to circulate cooled air within the first compartment of the food chamber. The second fan is in air flow communication with the second compartment of the food chamber through a second inlet opening and a second outlet opening in the one of the plurality of insulated walls. The second fan is configured to draw in air from the second compartment of the food chamber through the second inlet opening and push air into the second compartment of the food chamber through the second outlet opening such that air travels through the heated air flow pathway and over the heating element to circulate heated air within the second compartment of the food chamber. The food delivery container further includes a power supply configured to supply electrical power to at least one of the first fan, the second fan, the cooling element, or the heating element.

[0057] Additional example systems, apparatuses, and methods are described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0058] Having thus described the energy monitoring system in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0059] FIG. **1** illustrates an example food delivery container according to some example embodiments;

[0060] FIG. **2** illustrates an example food delivery container including a climate control system and maintenance access flaps according to some example embodiments;

[0061] FIGS. **3-5** illustrate example food delivery containers including climate control systems according to some example embodiments;

[0062] FIG. **6** illustrates a top partially-transparent view of an example food delivery container according to some example embodiments;

[0063] FIG. **7** illustrates a bottom partially-transparent view of an example food delivery container according to some example embodiments;

[0064] FIG. **8** illustrates a perspective partially-transparent view of an example food delivery container according to some example embodiments;

[0065] FIG. **9** illustrates example food packages according to some example embodiments;

[0066] FIGS. **10**A and **10**B illustrate an example of loading food packages into an example food delivery container according to some example embodiments;

[0067] FIGS. **10**C and **10**D illustrate example food chambers for receiving food packages according to some example embodiments;

[0068] FIG. **11** illustrates an example partitioned food delivery container according to some example embodiments;

[0069] FIG. **12** illustrates a perspective view of an example food package support including example food packages according to some example embodiments;

[0070] FIG. **13** illustrates a bottom view of an example food package support and example food packages according to some example embodiments;

[0071] FIGS. **14**A-**14**D illustrate various views of an example food package having a plurality of ribs according to some example embodiments;

[0072] FIGS. **15**A-**15**C illustrate example user interfaces for control of one or more food delivery containers according to some example embodiments;

[0073] FIG. **16** illustrates a block diagram of a food delivery system/environment according to some example embodiments;

[0074] FIG. **17** illustrates a block diagram of an example apparatus for food delivery within an example food delivery system/environment according to some example embodiments; and

[0075] FIG. **18** illustrates an example method of temperature control of a food delivery container according to some example embodiments;

[0076] FIG. **19** illustrates an example method of humidity control of a food delivery container according to some example embodiments;

[0077] FIG. **20** illustrates an example method of displaying power supply status of a food delivery container according to some example embodiments;

[0078] FIG. **21** illustrates an example method of preheating a food delivery container according to some example embodiments; and

[0079] FIG. **22** illustrates an example method of determining an order status according to some example embodiment.

DETAILED DESCRIPTION

[0080] Some example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all example embodiments are shown. Indeed, the examples described and pictured herein should not be construed as being limiting as to the scope, applicability or configuration of the present disclosure. Rather, these example embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout. Furthermore, as used herein, the term "or" is to be interpreted as a logical operator that results in true whenever one or more of its operands are true.

[0081] As used in herein, the terms "component," "module," and the like are intended to include a computer-related entity, such as but not limited to hardware, firmware, or a combination of hardware and software. For example, a component or module may be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, and/or a computer. By way of example, both an application running on a computing device and/or the computing device can be a component or module. One or more components or modules can reside within a process and/or thread of execution and a component/module may be localized on one computer and/or distributed between two or more computers. In addition, these components can execute from various computer readable media having various data structures stored thereon. The components may communicate by way of local and/or remote processes such as in accordance with a signal having one or more data packets, such as data from one component/module interacting with another component/module in a local system, distributed system, and/or across a network such as the Internet with other systems by way of the signal. Each respective component/module may perform one or more functions that will be described in greater detail herein. However, it should be appreciated that although this example is described in terms of separate modules corresponding to various functions performed, some examples may not necessarily utilize modular architectures for employment of the respective different functions. Thus, for example, code may be shared between different modules, or the processing circuitry itself may be configured to perform all of the functions described as being associated with the components/modules described herein. Furthermore, in the context of this disclosure, the term "module" should not be understood as a nonce word to identify any generic means for performing functionalities of the respective modules. Instead, the term "module" should be understood to be a modular component that is specifically configured in, or can be operably coupled to, the processing circuitry to modify the behavior and/or capability of the processing circuitry based on the hardware and/or software that is added to or otherwise operably coupled to the processing circuitry to configure the processing circuitry accordingly.

Example Food Delivery Containers

[0082] FIG. **1** illustrates an example food delivery container **10** according to some example embodiments. The food delivery container (e.g., an insulated food container (IFC)) **10** may be configured to carry various food products, such as, for example, cans, bottles, deli trays, takeout food packages, sandwiches, food pans, pizzas, or the like. The IFC **10** may include a plurality of insulated walls **12**, such as a top wall **12**A, a bottom wall **12**B, and side walls **12**C, forming a food chamber within.

[0083] In some embodiments, the insulated walls **12** may be formed from open cell foam insulation or closed cell foam insulation including, but not limited to, polyvinyl chloride (PVC) foam insulation, polyurethane (PU) foam insulation, and polyester foam insulation. The foam insulation may limit or prevent heat transfer from an interior portion of the IFC **10** to the external environment, thereby keeping the food within the IFC **10** hotter for a longer period of time. In some embodiments, the foam insulation may be rigid (e.g., hard or semi-hard), which may provide for a rigid IFC **10**. Alternatively, the IFC **10** may include a soft foam, which may provide for the IFC **10** to be collapsible, such as to minimize the IFC **10** volume when not in use.

[0084] In addition to the foam insulation, the insulated walls **12** may include an exterior cover material (e.g., fabric), which may protect the foam insulation. The exterior fabric may also be water resistant, preventing moisture entry to the food chamber during delivery, such as in poor weather conditions (e.g., in sleet, snow, or rain). In some examples, the exterior cover material may be a vinyl cover that has low or no breathability for air or moisture. Alternatively, the exterior cover material may be a nylon cover that has a relatively high breathability for both air and moisture, such as to enable steam to escape the IFC to reduce the humidity and moisture within the IFC **10**.

[0085] The IFC **10** may include at least one insulated wall **12** that is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber. In the depicted embodiment of FIG. **1**, the movable insulated wall is shown as the top wall **12**A. In some embodiments, other walls (or multiple walls) may be used, such as a side wall **12**C. The IFC **10** may include a closure **14** configured to maintain the movable insulated wall **12** in the closed position. The closure **14** may include one or more of a hook-and-loop closure, a zipper closure, a slide release buckle closure, or the like.

[0086] The IFC **10** may include one or more carrying elements **15** to enable a user to easily pick up and move the IFC **10**. The carrying elements may include, without limitation, one or more of handles, hack straps, or shoulder straps. The carrying elements, may be formed from nylon webbing, fabric, leather, simulated leather, or the like.

[0087] The interior of the insulated walls **12**, e.g. within the food chamber, may include an internal covering (an example interior is shown in FIG. **10**B). The internal covering may be a nylon covering, PVC covering, or other suitable material. The nylon covering may be water resistant and allow steam or moisture to escape the food chamber, reducing the moisture and humidity within the food chamber. The PVC covering may be resistant to moisture absorption, enabling a leak proof food chamber that may be easily cleaned and sanitized. In some example embodiments, the internal covering may form a removable liner that may be removed and replaced for cleaning or in the event of damage.

[0088] FIG. **2** illustrates an example food delivery container including a climate control system **20** and maintenance access flaps **18** according to some example embodiments. As discussed in further detail below, the IFC **10** may include a climate control system **20**. The climate control system **20** may include a climate control portion **22** and a power portion **24**. The climate control portion **22** may include one or more heating elements (and/or cooling elements) and a fan configured to circulate heated (and/or cooled) air within the food chamber. The power portion **24** may be configured to supply electrical power to the climate control portion **22**, such as through a power cable **26**. In an example embodiment, the climate control system **20** is disposed within the insulated walls **12** of the IFC **10**. In the depicted example, the climate control portion **22** is disposed within the top wall **12**A and the power portion **24** is disposed in the bottom wall **12**B. The depicted example is merely for illustrative purposes and one of ordinary skill in the art would immediately appreciate that the climate control unit **20** may be disposed in any of the insulated walls **12**. Further, the climate control portion **22** and power portion **24** may be disposed separately, e.g. in different insulated walls **12**, as depicted, or in the same insulated wall **12**. Additionally, although depicted separately, the climate control portion **22** and the power portion **24** may be housed in a common enclosure.

[0089] In some example embodiments, the IFC **10** may include one or more maintenance accesses **18**, such as maintenance flaps. The maintenance accesses **18** may be configured to enable access to the climate control system **20** for maintenance, replacement, and/or inspection. The maintenance accesses **18** may include a closure, such as one or more of a hook-and-loop closure, a zipper closure, a slide release buckle closure, or the like.

[0090] FIGS. **3-5** illustrates example food delivery containers including climate control systems according to some example embodiments.

[0091] FIG. **3** depicts an IFC **30**A similar to the IFC **10** discussed above in reference to FIGS. **1** and **2**, including insulated walls **32** (e.g., top wall **32**A, bottom wall **32**B, and side walls **32**C) forming a food chamber **34**.

[0092] The IFC **30**A includes a climate control system having a temperature control element or "temperature element." The temperature element may be a heating element, such as a resistive heating coil or other suitable heat source, a cooling element, such as a refrigeration unit or other suitable cooling source, or may be configured to provide both heating and cooling, such as a thermoelectric generator (TEG), such as a Peltier plate. The TEG may be configured to provide heat when current is applied to the TEG in a first direction and provide cooling when current is applied in a second direction. More particularly, a first side of the TEG may be configured to provide heating or cooling for the climate control system and a second side of the TEG may be configured as a heat or cooling sink. The examples provided below include a heating element for illustrative purposes. One of ordinary skill in the art, however, would immediately appreciate that the same thermodynamic principals described in the context of heating the food chamber apply equally to cooling the food chamber **34**.

[0093] In some example embodiments, the IFC **30**A includes a heating element **36** and a fan **38**. In the depicted embodiment, the heating element **36** and fan **38** are disposed in a top wall **32**A, and a power supply **40** (discussed below) is disposed in a bottom wall **32**B. The fan **38** may circulate air within the food delivery container such as through the climate control system into the food chamber **34**. The fan **38** may be an axial flow fan, a centrifugal fan (e.g. blower), or a cross-flow fan, among other fan types.

[0094] In some example embodiments, discussed below in reference to FIGS. **6-8**, the climate control system may include an air flow pathway, and the heating element **36** may be disposed within the air flow pathway. The fan **38** may be in air flow communication with the food chamber **34** through an inlet opening and an outlet opening in one of the insulated walls **32**. The fan **38** may be configured to draw in air from the food chamber through the inlet opening and push air into the food chamber through the outlet opening, such that air travels through the air flow pathway and over the heating element **36** to circulate heated air within the IFC **30**A, particularly within the food chamber **34**. The circulating heated air applies convection heat to the food chamber **34**.

[0095] The IFC **30**A may include a power supply **40** configured to supply electrical power to the fan **38** and/or the heating element **36**. The power supply may be a replaceable power source, such as alkaline batteries, or a rechargeable power source, such as lithium batteries or one or more capacitors, such as super capacitors. The rechargeable power source may include cylindrical batteries (e.g., depicted in FIG. **3**) and/or capacitors and/or flat pack, e.g. credit card, batteries or capacitors (e.g., depicted in FIG. **4**). Additionally or alternatively, the power supply may include a wired power supply, such as a DC vehicle plug or an AC wall plug, configured to receive AC or DC power from a power source to power the climate control system and/or recharge the rechargeable power source.

[0096] In some example embodiments in which the IFC **30**A includes a rechargeable power supply **40**, the IFC **30**A may include a wireless charging element **44** configured to receive an inductive charge and charge the rechargeable power supply **40**. In some example embodiments, the wireless charging element **44** may include an inductive charging coil configured to be placed in proximity to an inductive charging pad **46**. The inductive charging pad **46** may include one or more inductive charging coils powered by a wired power supply **48**. The wired power supply **48** may be configured to receive AC or DC power from a power source, such as a vehicle DC power socket or an AC wall socket. The inductive charging pad **46** may generate a magnetic field that induces a voltage in the inductive charging coil that may be utilized to charge the rechargeable power supply **40**. In use, the inductive charging pad **46** may be placed on a car seat or trunk to charge the IFC **30**A when the IFC **30**A is in transit to deliver food products. Additionally or alternatively,

the inductive charging coil **46** may be placed on a counter, shelf, or storage area to charge the IFC **30**A when the IFC **30**A is not in use, being loaded with food products, or being pre-heated, as discussed herein.

[0097] In some example embodiments, IFC **30**A may control the electrical power supplied to at least one of the fan **38** or heating element **36** to maintain the temperature of the food chamber **34** at a predetermined temperature or within a predetermined temperature band. For example, the IFC **30**A may include one or more temperature switches configured to open at a first temperature at a high end of the temperature band, such as 200 degrees and close at a second temperature at a low end of the temperature hand, such as 150 degrees. In an example in which the food chamber **34** is cooled, the temperature switches may have an upper temperature at 30 degrees or 50 degrees and a lower temperature at 0 degrees or 35 degrees, for frozen or chilled food products, respectively. In some embodiments, the IFC **30**A may utilize the one or more temperature switches for safety, e.g. the high temperature switch may be configured to de-energize the heating element to prevent damage to the IFC **30**A.

[0098] In some example embodiments, the IFC **30**A may include processing circuitry **42**, such as discussed in FIG. **16** in reference to processing circuitry **320**. The processing circuitry **42** may include or be in communication with one or more temperature sensors configured to measure the temperature of the food chamber **34**. The processing circuitry **42** may be configured to control the electrical power supplied to at least one of the fan **38** or heating element **36** to maintain the temperature of the food chamber **34** at predetermined temperature or within a predetermined temperature band.

[0099] In some example embodiments, the IFC **30**A may include a user interface **52** in communication with the processing circuitry **42**. The user interface may include one or more indicators, such as light emitting diodes (LEDs), a display, such as a liquid crystal display (LCD), a speaker, a buzzer, or the like. The user interface, in combination with the processing circuitry **42**, may generate user information, such as a beacon identifying a specific IFC from a plurality of IFCs, a charging status, a heating status, or other user information. The user interface **52** may be disposed on a top wall **32**A (depicted in FIG. **3**), on a side wall **32**C (depicted in FIG. **4**), or any other suitable location.

[0100] In some example embodiments, the IFC **30**A includes a humidity control element **50** configured to remove or add humidity to a volume of air within the food chamber **34** to maintain a predetermined humidity level or humidity band. The humidity control element **50** may include an absorbent fabric, desiccant, rechargeable desiccant, mixed salts, or the like. In some example embodiments, the humidity control element **50** includes a flow valve configured to limit air flow across the humidity control element when the flow valve is in a shut position. The IFC **30**A may include a humidity sensor configured to measure the humidity of the volume of air within the food chamber **34**. In some example embodiments, the processing circuitry **42** may receive humidity data from the humidity sensor and compare the humidity data to one or more humidity thresholds. In response to the comparison of the humidity data to the one or more humidity thresholds, the processing circuitry **42** may cause the flow valve to be opened when the humidity data exceeds the one or more humidity thresholds or be closed when the humidity data does not exceed the one or more humidity thresholds.

[0101] FIG. **4** depicts another example IFC **30**B in a second configuration. The IFC **30**B may include a first silicone heating pad **54**A and a second silicone heating pad **54**B. The silicone heating pads **54**A, **54**B may be disposed on the interior surface of the insulted walls **32**, such as side walls **32**B as shown. In some example embodiments, the first silicone heating pad **54**A is disposed proximate to a first insulated wall **32**C and the silicone second heating pad **54**B is disposed proximate to a second insulated wall **32**C opposite the first insulated wall.

[0102] In some example embodiments, the silicone heating pads **54** may be positioned within the food chamber **34** aligned with the one or more air passage outlets from the climate control system. In such a configuration, the silicone heating pads may add heat to the flowing air as the air flows past the silicone heat pads, e.g. adding to the convection within the food chamber **34**. Additionally or alternatively, the silicone heat pads **54** may be positioned on side walls **32**C not aligned with the one or more air passage outlet openings of the climate control system. In such a configuration, the silicone heat pads may radiate heat into the food chamber **34**, e.g. adding conductive heat.

[0103] The IFC **30**B may include a distributed processing circuitry including first processing circuitry **42**A and second processing circuitry **42**B. The first processing circuitry **42**A may be configured to control the heating element **36** and fan **38**. The second processing circuitry **42**B may be configured to control, the user interface **52**, the silicone heating pads **54**, and/or charging of the power supply **40** from the wireless charging element **44**.

[0104] In some example embodiments, the climate control system may also add conductive heat to the food chamber **34**. As discussed in further detail below in reference to FIGS. **6-8**, the radiative heat of the heating element **36** may be captured by one or more heat distribution elements that may reduce localized temperature peaking and apply conductive heat to the food chamber **34**. Similarly, heat generated by the power supply **40** may also be captured by the one or more heat distribution elements.

[0105] FIG. **5** depicts a further example embodiment of an IFC **30**C. In the depicted configuration, the IFC **30**C does not include a fan. Instead, the food chamber **34** is heated by one or more silicone heating pads **54**. The IFC **30**C includes a power supply **40**, wireless charging element **44**, a user interface **52**, and processing circuitry **42** similar to the respective elements discussed above in FIGS. **3** and **4**.

[0106] FIG. **6** and FIG. **8** illustrate an example top transparent view and a perspective transparent view of an IFC **30**, respectively, in a configuration similar to the IFC **30**A discussed in reference to FIG. **3**. The climate control system of IFC **30** may include the heating element **36**. The heating element **36** may be a resistive coil encased in one or more baffle plates. The baffle plates may, in some embodiments, create a tortuous pathway for air to travel through or past the heating element **36** to thereby increase heat transfer to the air. In some embodiments, the heating element **36** itself may include one or more air inlets and one or more air outlets. The climate control system of IFC **30** also includes a fan **38**. The fan **38** may be configured to draw in air from the food chamber **34**, such as through an inlet opening **64** (shown in FIG. **6**). The air exiting the fan **38** may be discharged into

or past the heating element **36** and discharge thereafter. The air may then pass through one or more air flow outlets **66** and into the food chamber **34**. In some example embodiments, the IFC **30** may include baffling, tubing, molding, or the like configured to create an air flow pathway from the inlet opening **64** to the outlet opening(s) **66**. In some example embodiments, the baffling is provided by a heat distribution element **60**. The heating element **36** and/or the fan **38** may be disposed within the air flow pathway, as discussed below. Along these lines, while shown with the heating element **36** being positioned downstream of the fan **38**, the climate control system may be arranged with the heating element **36** being positioned upstream of the fan **38** such that the fan pulls air past the heating element.

[0107] In some example embodiments, the IFC **30** includes a heat distribution element **60** disposed in the top wall **32**A. The heat distribution element **60** may comprise a plurality of metal plates, or other suitable heat conducting materials. The heat distribution element **60** may be configured to conduct heat radiated by the heating element **36** and/or fan motor (not shown) across the heat distribution element **60**. In some embodiments, the conduction of heat may add conductive heating to the IFC **30**, thereby reducing the electrical power consumption required to operate the IFC, e.g. recapturing lost radiative heat. Additionally, the heat distribution element **60** may reduce or prevent localization of heat, which may prevent damage to the IFC **30** and/or increase the effective life of the IFC **30**, as well as, in some cases, avoid non-uniform heating within the food chamber.

[0108] In addition to the heat transfer benefits, the heat distribution element **60** may also include a void or cut out **65** in one or more of the metal plates to create an air flow pathway (e.g., the above described air flow pathway). In some example embodiments, a top and bottom metal plate of the heat distribution element **60** may be substantially solid. One or more internal plates may include cutouts **65** to create a continuous air pathway between the inlet opening **64** and the one or more outlet openings **66**. The fan **38** and/or heating element **36** may be disposed within the air flow pathway formed by the cutouts **65**.

[0109] As depicted by the arrows in FIG. **6** and FIG. **8**, air from the food chamber **34** is drawn in through an inlet opening **64** into the air flow pathway, such as by the fan **38**. In the depicted embodiment, the fan **38** is a centrifugal fan having a central inlet opening facing the inlet opening **64**. Spinning of the fan **38** generates a low pressure area that draws air through the inlet opening **64** and a high pressure area about a periphery of the fan **38**. A fan outlet is disposed in a peripheral wall of the fan **38** to discharge high pressure air. The fan outlet is disposed proximate to the inlet of the heating element **36**. As the air passes through the heating element **36** the air is heated and discharged through outlets disposed on either side of the heating element **36**. As discussed above, the heating element **36** may include one or more internal baffles configured to lengthen the air path through the heating element **36** to increase the heat transfer to the air passing therethrough. The cutout **65** in the metal plates of the heat distribution element **60** may form an air duct extending from the outlets on each side of the heat element **36** to the outlet openings **66** disposed proximate to opposing side walls **32**C at opposite edges **33**A, **33**B of top wall **32**A. The heated air flows through the air duct and through the outlet openings **66** to the food chamber **34**, thereby circulating heated air within the food chamber **34**. Adding in the circulating of the heated air, the inlet opening **64** is disposed remote from the outlets opening **66**. Particularly, the inlet opening **64** is disposed proximate to a side wall **32** different from either of the outlet openings **66**. Additionally, the inlet opening **64** is disposed approximately equidistant from each of the outlet openings **66**.

[0110] In some example embodiments, the heat distribution element **60** may also include cutouts for the processing circuitry **42** and be configured to conduct heat generated by the processing circuitry **42**, such as by a processor. In some example embodiments, a cutout in the top plate of the heat distribution element **60** and/or the top wall **32**A of the IFC **30** may be included for access to the user interface **52**. In this depicted embodiment, the user interface includes an LED.

[0111] FIG. **7** illustrates an example bottom partially transparent view of the IFC **30** according to some example embodiments. As depicted in FIG. **7**, and referring to FIG. **8**, a power portion of the climate control system of the IFC **30** may be disposed in the bottom wall **32**B. The positioning of the climate control portion of the climate control system in the top wall **32**A and the power portion in the bottom wall **32**B may provide balance to the IFC **30**, preventing the IFC **30** from being top heavy or bottom heavy. The power portion of the climate control system may include one or more power supplies **40** and a wireless charging element **44**, configured to provide electrical power to the climate control portion of climate control system.

[0112] In the depicted example, the power supplies comprise four cylindrical power supplies disposed at the corners of bottom wall **32**B. The power supplies **40** may be rechargeable batteries, capacitors, or the like. The power supplies **40** may be relatively heavy and, thus, distribution of the power supplies **40** about the bottom wall **32** may allow the IFC **30** to have a more balanced weight distribution.

[0113] The wireless charging element **44** includes an inductive charging coil configured to receive an induced voltage from an inductive charging pad and provide electrical power to the power supplies to recharge the batteries and/or capacitors. In the depicted embodiment, the inductive charging coil is disposed at a relatively central location in the bottom wall between the power supplies **40**. The central location (and positioning in the bottom wall) may increase the likelihood of the inductive coil being within the magnetic field of an inductive charging pad, when placed thereon, and reduce wiring harness lengths to each of the power supplies **40**.

[0114] In some example embodiments, a second heat distribution element **62** is disposed in the bottom wall **32**B. Similar to the heat distribution element **60** discussed above in reference to FIG. **6**, the second heat distribution element **62** may be formed from one or more metal plates or other suitable heat conductive materials. The second heat distribution element **62** may be disposed proximate to the one or more power supplies **40** and/or wireless charging element **44**. For example, one or more of the metal plates of the second heat distribution elements may have cutouts disposed therein configured to receive the power supplies **40**. The second heat distribution element **62** may be configured to conduct radiative heat from the power supplies **40**. The conduction of heat by the second heat distribution elements **62** may reduce localized heat caused by the power supplies limiting or preventing damage and extending the effective life of the IFC **30** and preventing non-uniform heating of the

food products within the food chamber. Additionally, the conduction of heat may add conductive heating to the IFC **30** to reduce the electrical power consumption required to operate the IFC **30**, e.g. recapturing radiative heat from the power supplies reducing the heat load on the heating element **36**.

[0115] In some example embodiments, the IFC **30** may include an identifier reader **45**, such as a barcode reader, character reader, quick response (QR) code reader, or RFID reader. The identifier reader **45** may be disposed in an insulated wall **32**, such as the top wall **32**A or the bottom wall **32**B, in a location suitable for reading an identifier associated with one or more food packages when the food packages are placed into the food chamber **34**. The identifier reader **45** may provide identification data to the processing circuitry **42** to determine an order status, a target temperature or temperature band, or the like. In this regard, in some embodiments, the order status can be confirmed prior to delivery, such as enabling a remote operator to confirm completion of the order. Additionally or alternatively, the identifier reader **45** may write information to the identifier. For example, the identifier reader **45** may write the time the food package **70** was placed into the food chamber **34**, the temperature of the food chamber at one or more times, the target temperature or target temperature band, or the like.

Example Food Packages and Food Package Supports

[0116] FIG. **9** illustrates example food packages according to some example embodiments. The food industry includes various types of food packages. The food packages may be configured for the type of food being delivered, the heat of the food, moisture content of the food, or the like. Some typical food packages intended for use with various example food delivery containers may include a folded food package **70**A, a sealed lid food package **70**B, a clam shell food package **70**C, or the like. The food packages may be formed from a variety of materials including paper board, molded pulp, foam, plastic, biodegradable composite materials (e.g. sugarcane or corn starch), aluminum, or the like. In some examples, the food packages may be reusable, e.g. the food packages may be returned to the food provider, washed, and used to deliver food again.

[0117] In some example embodiments, the food packages **70** may include an identifier **71**. The identifier may be printed or embedded into the food package **70** or may be printed or embedded in a label placed on the food package **70**. The identifier **71** may include data corresponding to a target temperature or target temperature band, the food product contained therein, the time prepared, an order number, or the like. The identifier may include one or more characters (e.g. numbers, letters, symbols, or the like), a barcode, a quick response (QR) code, a radio frequency identifier (RFID), or the like. The identifier **71** may be read by the identifier reader **45** associated with the IFC **30** to determine an order status, such as, all ordered food products are placed into the food chamber **34**. Additionally or alternatively, the identifier **71** may be written to by the identifier reader **45**. For example, the identifier reader **45** may write the time the food package **70** was placed into the food chamber **34**, the temperature of the food chamber at one or more times, the target temperature or target temperature band, or the like.

[0118] FIGS. **10**A and **10**B illustrate an example of loading food packages into an IFC **30** according to some example embodiments. In some example embodiments, food packages **70** may be vertically stacked and placed into a bag **72**, such as by order or delivery location. In some example embodiments, order information may be placed on the bag, food packages, or on the IFC **30**. For example, the IFC **30** may include a plastic transparent window on an exterior surface of an insulated wall **32**. The window may be configured for order information to be placed within the window for quick reference by a user, such as a delivery person.

[0119] At least one of the insulated walls **32**, such as the top wall **32**A, may be movable between a closed position and an open position to enable food packages to be placed within or removed from the food chamber **34**. The insulated wall **32** may be moved to the open position and the bag **72** may be placed within the food chamber **34** of the IFC **30**. The insulated wall **32** may then be placed in the closed position and sealed.

[0120] FIGS. **10**C and **10**D illustrate example food chambers **34** including wall protrusions **76** extending from an insulated wall **32** into the food chamber **34**. One or more wall protrusions **76** may be disposed on one or more of the insulated walls **32** (or at corners between the walls). The wall protrusions may be configured to enable complementary food packaging to be placed into the food chamber and limit or prevent non-complementary food packaging from being placed into the food chamber. For example, food packages **70** may include a complementary recess in one or more edges of the food package **70**, such that when placed into the food chamber, the one or more wall protrusions align with the one or more complementary recesses. Further, food packages **70** not having complementary recesses may be prevented or limited from being placed into the food chamber.

[0121] Additionally or alternatively, the wall projections **76** may be configured to channel heated or cooled air through the respective one or more wall projections. In an example embodiment, the wall projections **76** may be aligned with the inlet opening **64** and/or the outlet openings **66** of the IFC **30** to aid in circulating of the heated or cooled air, such as from the top wall **32**A throughout the food chamber **34**. In some example embodiments, the wall projections **76** may also include one or more flow holes **78** configured to enable air flow from the wall projection into the food chamber. The flow holes may be disposed at opposing ends of the wall projections **76**, at intervals along the wall projections **76**, or at any other suitable location to enable a desired air circulation.

[0122] FIG. **11** illustrates an example partitioned IFC **30'** according to some example embodiments. The partitioned IFC **30'** may include a plurality of food chambers **34***a*', **34***b*', **34***c*' that may be formed in the IFC **30'**, such as by segmenting a food chamber using partition walls **80**. The partition walls **80** may be insulated walls, similar to insulated walls **32**. Additionally or alternatively, the partitions may include fabric, plastic, metal, or the like.

[0123] In some example embodiments, the IFC **30'** may have a side wall **32**C' (not shown) that moves between a closed position and open position to allow access to the plurality of food chambers **34'**. In some example embodiments, one or more of the food chambers **34***a*', **34***b*', **34***c*' may be climate controlled. In some example embodiments,

some or all of the food chambers may be climate controlled by a common climate control system. Alternatively, in some example embodiments, different climate control systems may be used for each food chamber. For example, a first food chamber **34***a*' may be climate controlled by a first climate control system and a second food chamber **34***b*' may be climate controlled by a second climate control system. In some example embodiments, the IFC **30**' may include both climate controlled and non-climate controlled food chambers. In the depicted embodiment, the IFC **30**' includes a first food chamber **34***a*' climate controlled by a first climate control system, a second food chamber **34***b*' that is not climate controlled, and a third food chamber **34***c*' that is climate controlled by a second climate control system.

[0124] In some example embodiments, the first food chamber **34***a*' may be climate controlled to maintain a target temperature of 150-160 degrees, for heated food products. The third food chamber **34***c*' may be climate controlled to maintain a second target temperature band of 40-50 degrees, for chilled food products. In such an embodiment, a single IFC **30**' may be deployed for a food order, such as pizza, soda, and salad, and maintain suitable temperatures for both heated and chilled food products.

[0125] FIG. **12** illustrates a perspective view of an example food package support **100** including example food packages **120** according to some example embodiments. In some embodiments, the food package support **100** may be configured to cooperate with the IFC **30** to maximize air circulation within a food chamber **34**. The food package support **100** may be configured to be inserted into the food chamber **34** of an IFC **30**. As discussed below, air flow holes **110** disposed in the food package support **100** may enable the heated/cooled air to circulate between food packages **114** placed in the food chamber **34**.

[0126] The food package support **100** may include a plurality of food package receptacles **102** defined by a plurality of receptacle walls. The plurality of receptacle walls may include common side walls **104** disposed on opposite sides of the food package support **100**. The plurality of receptacle walls may also include an upper wall **106** and lower wall **108** for each of the plurality of food package receptacles **102**. In some example embodiments, the food package support **100** may include a rear wall (not shown). The upper walls **106** and lower walls **108** of the plurality of food package receptacles **120** may include flow holes **110** enabling air flow through the food chamber **34**. In some example embodiments, one or more of the flow holes **110** may be configured to be aligned with the inlet opening **64** and/or the outlet openings **66** of the climate control system. In an example embodiment, the food package support **100** may include one or more handles **119** to facilitate insertion and removal of the food package support **100** from the IFC **30**.

[0127] Referring briefly to FIGS. **13**-**14**D, the food packages **114** may also be configured to maximize heated/cooled air circulation within the food chamber **34**. Particularly, the food packages **114** may have one or more concave edges **120**A, **120**B. For example, the food package **114** may include two or more projections **123** extending from a lid **121** or food receiving portion **122** defining the concave edges **120**. In the example depicted in FIG. **12**, the food package includes a first set of concave edges **120**A disposed on a long side of the food package **114** and a second set of concave edges **120**B disposed on a short side of the food package **114**. In an example embodiment, one or more of the concave edges **120** may be aligned with the flow holes **110** and/or the inlet opening **64** or an outlet opening **66**.

[0128] Turning back to FIG. **12**, the food package support **100** may include a plurality of pinch slots **112** disposed on the common side walls **114** in each of the plurality of food package receptacles **102**. The pinch slots **112** may be configured to engage a surface of a food package **114**, such as the projections **123** to limit opening of the food package **114** when inserted into the food package receptacle **102**. The pinch slots **112** may include a tapered open end configured to guide the food packages projections **123** into the pinch slots **112**.

[0129] In some example embodiments, the upper wall **106** or the lower wall **108** of each of the food package receptacles **102** may include one or more ribs **116** configured to engage a complimentary one or more ribs **116**' (FIGS. **14**A and **14**D) disposed on a bottom **122** or top **121** of a food package **114**. In the embodiment depicted in FIG. **14**D, the ribs **116***a*' may include a taper that enables easier insertion into the food package receptacle **102**. The interaction of the ribs **116**, **116**' may prevent lateral movement of the food package **114**. Additionally, the ribs **116** may include rib flow holes **118** enabling heated/cooled air to flow through the one or more ribs **116**. The rib flow holes **118** may be disposed at a first end and second end of the ribs **116**, or may be disposed at any other suitable location.

[0130] Turning to FIGS. **14**A-**14**D, the food package **114** may include a food receiving portion **122** including a first mating surface **125** about a periphery of the lower receiving portion **122**. The food package **114** may also include the lid **121** including a complementary mating surface **127** configured to seal the food package **114** when engaged with the mating surface **125** of the food receiving portion **122**.

[0131] The lid **121** may include ribs **116**' configured to enable heated/cooled air to flow between vertically stacked food packages **114**. Additionally, the ribs **116**' may be configured to accept the complementary ribs **116** of the food package support **100**, as discussed above. In an example embodiment, depicted in FIG. **14**D, the ribs **116***a*' may be recessed from the ends of the food package **114** forming an air funnel **132**. The air funnel **132** may cause a mass flow rate of the air to increase as the air moves across the lid **121** through the ribs **116***a*', thereby increasing heat transfer.

[0132] In some example embodiment, the food package **114** may include a recess or projection **130** disposed on the food receiving portion **122** configured to engage a complementary projection or recess **128** in the lid **121**. The recesses and projections **128**, **130** of the lid **121** and food receiving portion **122** may limit lateral movement between stacked food packages, preventing or limiting sliding of food packages on one another. In some example embodiments, the recesses and projections **128**, **130** of the lid **121** and food receiving portion **122** may interlock or clip together to form a unified food package from a plurality of food packages **114**.

Example User Interfaces and Controls

[0133] FIGS. **15**A-**15**C illustrate example user interfaces (such as through software applications) for control of an IFC **30** according to some example embodiments. A user interface may be provided for control of one or more IFCs at any, some, or all of an IFC, a mobile computing device (e.g. a smart phone, computing tablet, or the like), a computer

terminal, a POS device, or the like. The examples below are generally discussed in the context of the user interface disposed at a remote computing device for explanatory purposes. Additionally, control functions are generally discussed as emanating from the remote computing device for explanatory purposes, however these control functions may be performed locally at the IFC **30**, at a computing device, at a POS device, or a combination thereof.

[0134] As depicted in FIG. **15**A, a computing device may receive status data regarding a plurality of IFCs **30**. The status data may include one or more of temperature data, humidity data, battery status data, delivery status, lid position, selected temperature or temperature band, or the like. A user interface **200** may include a plurality of IFC data icons **202**. Each of the data icons may include an IFC identifier **204**, such as a number, letter, character, shape color, or the like. The IFC data icons **202** may display at least a portion of the status data. For example, in the depicted example, the IFC data icons **202** include a current temperature **206**, a current humidity **208**, and a current power supply status **210** for the respective IFC.

[0135] In some example embodiments, an IFC control user interface **200'** may be provided, as depicted in FIG. **15**B. A user may select an IFC data icon **202**, causing the computing device to open an IFC control user interface **200'** for the respective IFC. The IFC control user interface **200'** may include some or all of the status data, including but not limited to, the current humidity **212**, the current temperature **214**, current battery status **216**, or the like. Additionally, the IFC control user interface **200'** may include a manual temperature control **216**. The manual temperature control may enable a user to enter a user input defining a target temperature and/or a target temperature band, such as 150 or 150-160 degrees, 45 or 40-50 degrees, 10 or 5-20 degrees or other suitable temperatures or temperature bands. In some example embodiments, a plurality of predefined temperature bands may be selectable in a temperature selection user interface **200"**, as depicted in FIG. **15**C. The temperature selection user interface **200"** may include a plurality of selectable temperature icons **224**. The temperature icons **224** may indicate a temperature or temperature band value (e.g. 150-160 degrees, 5-20 degrees, 40-50 degrees, or the like), a food type (e.g. Chinese, quick service pasta, pizza, soda, ice cream, or the like) or other suitable indicator of temperature bands. The target temperature of temperature band may be transmitted to the IFC **30** for the processing circuitry **42** to execute. In some embodiments, the processing circuitry **42** may control the temperature of the food chamber **34** by controlling the electrical power supplied to at least one of the fan **38** or heating/cooling element to maintain the temperature of the food chamber at the target temperature or temperature band.

[0136] In some embodiments, the IFC control user interface **200'** may include a beacon function configured to generate a beacon request. The beacon request may be transmitted to the IFC **30** for the processing circuitry **42** to execute. The processing circuitry **42** may cause the user interface **52** to generate an audio or visual alert. The alert may assist the user in identifying a specified IFC **30** from a plurality of IFCs. The alert may include illumination of a light or LED, change in LED color, a chirp, or other suitable alert. In some embodiments, selection of the beacon icon **220** may enable or disable a beacon function, such as described herein.

[0137] In some example embodiments, the IFC control user interface **200'** may include a boost function **218**. The boost function may enable a user to generate a boost request that is transmitted to the IFC **30**. The processing circuitry **42** of the IFC **30** may cause control of the electrical power supplied to at least one of the fan **38** or heating/cooling element **36** to maintain the temperature of the food chamber **34** at a second temperature or in a second temperature band that is higher than the first target temperature or first target temperature band, such as 170-190 degrees. In some embodiments, selection of the boost icon **218** may enable or disable a boost function, such as described herein.

[0138] In some example embodiments, the IFC **30** may include a temperature sensor (or a plurality of temperature sensors) in communication with processing circuitry **42** of the IFC **30**. The temperature sensor may be configured to measure the temperature of a food chamber **34** of the IFC **30**. The processing circuitry **42** may receive temperature data from a temperature sensor. In some embodiments, the IFC **30** may transmit the temperature data to a remote computing device for display and/or control functions. The computing device may receive the temperature data and generate one or more control signals to control the electrical power supplied to at least one of the fan **38** or the heating/cooling element to maintain the temperature of the food chamber **34** in a first predetermined temperature or temperature band (e.g. a target temperature band), such as 150-160 degrees, or in a second predetermined temperature or temperature hand, such as 170-190 (e.g. a boost temperature band). The computing device may transmit the control signals to the IFC **30** for execution by processing circuitry **42**. The processing circuitry **42** may control the temperature of the food chamber **34** by controlling the electrical power supplied to at least one of the fan **38** or heating/cooling element to maintain the temperature of the food chamber at the target temperature or temperature band or boost temperature or temperature band.

[0139] In some example embodiments, the IFC **30** may include a humidity sensor in communication with the processing circuitry **42**. The humidity sensor may be configured to measure the humidity of the volume of air within the food chamber **34**. In some embodiments, the IFC **30** may transmit the humidity data to a remote computing device for display and/or control functions.

[0140] In some example embodiments, the IFC **30** may include a humidity control element **50** configured to remove or add humidity to a volume of air within the food chamber **34** to maintain a predetermined humidity level or humidity band and/or a flow valve configured to limit air flow across the humidity control element when the flow valve is in a shut position. The computing device may receive the humidity data and compare the humidity data to one or more humidity bands or thresholds, such as 60%, 60-65%, or other suitable humidity level or band. The computing device may generate and transmit one or more control signals, e.g. a humidity control request, to the IFC to cause the flow valve to be opened when the humidity data exceeds the humidity threshold or be closed when the humidity data does not exceed the humidity threshold.

[0141] In some example embodiments, the IFC **30**, vehicle associated with the IFC **30**, or remote computing device associated with the IFC **30** may include a position sensor, such as a global positioning system (GPS) sensor. The computing device may be configured to determine a current location of the IFC **30** based on position data received from

the position sensor. Using the current location, the computing device may be configured to automatically generate a boost request or beacon request based on a proximity to a delivery location. The computing device may determine a delivery location, such as via a user input defining the delivery location, via a user interface, or via ebbing received from a POS device. The computing device may compare the current location to the delivery location, and generate a boost request in response to the current location being within a predetermined boost threshold distance from the delivery location. The boost threshold distance may be a predetermined distance or estimated time to arrival sufficient to raise the temperature of the food product to an optimal (e.g., second) temperature. For example, the boost threshold distance may be 5 miles, 10 miles, 5 minutes, 10 minutes, or other suitable value. The computing device may cause the boost request to be transmitted to the IFC **30**. The processing circuitry **42** of the IFC **30** may then cause control of the electrical power supplied to at least one of the fan **38** or heating/cooling element to maintain the temperature of the food chamber **34** at a boost temperature or within a boost temperature band that is higher than the first temperature or temperature band.

[0142] With regard to the beacon request, the computing device may compare the current location to the delivery location, and generate a beacon request in response to the current location being within a predetermined beacon threshold distance from the delivery location. The beacon threshold distance may be a predetermined distance from the delivery location indicative of arrival at the delivery location, such as 100 ft., 1000 ft., or other suitable distance. The beacon request may cause the IFC **30** to cause a user interface to generate an audio or visual alert. The alert may assist a user in identifying an IFC **30** associated with the delivery location (such as may be useful when more than one IFC is present). An advantage of such a mode is that it enables proper selection of the IFC for the delivery without having to open the IFC for visual confirmation (thereby effecting the temperature within the IFC). This also removes a possibility for mistaking the order through human error (e.g., forgetting which order is for which delivery location).

[0143] In some example embodiments, the computing device may utilize food product information to determine various factors for the IFC. For example, the computing device may determine a suitable IFC (from among various IFCs) for the selected food products, such as based on size, the determined target temperature band, and/or an estimated completion time for preparation of the food products. This information may be utilized to automatically determine an IFC and, in some embodiments, cause the IFC to pre-heat to the determined target temperature band, such as by an estimated completion time. Additionally, the computing device may cause the selected IFC to provide an audio or visual alert to identify itself to a food service operator to confirm proper IFC selection and/or that the IFC has completed the pre-heating/pre-cooling.

[0144] In some example embodiments, the computing device may receive user input defining a food product, such as though the user interface or from a POS device. The computing device may determine size, e.g. a total volume, of the delivery based on one or more defined food products. For example, the computing device may access a memory including a table having volume values for the food products, which may be summed to determine a total volume. Additionally or alternatively, the computing device may include a default volume for one or more food products which may be summered to determine the total volume of the delivery. The computing device may then determine an appropriate IFC based on the total delivery volume.

[0145] In some example embodiments, the computing device may determine a target temperature based on the food product(s). For example, the computing device may access a memory including a table having temperature values for the food products. Similarly, the computing device may determine one or more humidity thresholds based on the food products by accessing a table including humidity values for the respective food products. The computing device may cause the IFC to maintain a target temperature band based on the temperature values for the respective food products of the delivery. Additionally, the computing device may cause the IFC to maintain a target humidity level or humidity band based on the humidity values for the respective food products of the delivery.

[0146] In some example embodiments, the computing device may cause a selected IFC to pre-heat or pre-cool to the target temperature based on receiving the food product information. In some such embodiments, the computing device (e.g., of a user device utilizing a corresponding software application or of the IFC directly) may determine that the target temperature or temperature band has been reached and cause a corresponding alert or notification to indicate that pre-heating is complete. In some embodiments, the alert or notification may comprise illumination of an LED on the user interface of the IFC, such as similar to a beacon request described herein. Additionally or alternatively, a message may be sent to one or more devices/systems (e.g., a user device (such as a third-party user device or a restaurant user device), a server, a POS system, etc.) to indicate that pre-heating (or pre-cooling) has been completed. In some such embodiments, the corresponding IFC number may be included (e.g., "IFC No. 3 is pre-heated for Order No. 52"). In some embodiments, other alerts or notifications are contemplated.

[0147] In some embodiments, the computing device may determine an estimated completion time for the food products of the delivery and cause the IFC to pre-heat or pre-cool, such that the IFC is at the target temperature at the estimated completion time. The computing device may receive the user input defining a food product, such as though the user interface or from a POS device. The computing device may determine an estimated completion time based on the food product. For example, the computing device may access a memory including a table having completion time values for the food products. The computing device may then select the lowest or highest completion time and cause the IFC to control the electrical power supplied to at least one of the fan **38** or the heating/cooling element, such that the temperature of the food chamber **34** is within the target temperature band at the estimated completion time. In some example embodiments, the user interface of the IFC **30** may display a pre-heating or pre-cooling status, such as yellow indicating pre-heating or pre-cooling and green indicating that the IFC is at the target temperature.

[0148] In some example embodiments, the processing circuitry **42** may be configured to determine a power supply status, such as a charge level, whether the power supply is charging, whether it is plugged in, among other things. In

some embodiments, in response, the processing circuitry **42** may cause the user interface **52** of the IFC **30** to indicate the power supply status. The indications of power supply status may include, without limitation, a green light to indicate that the power supply is charged greater than a first threshold, such as 80 percent, a yellow light to indicate that the power supply is charged less than a second threshold such as 50 percent, and a red light to indicate that the power supply is charged less than a third threshold, such as 20 percent. Additionally or alternatively, the indications of power supply status may include a green blinking light for when the power supply is plugged in and a blinking red light for indicating that wireless charging is occurring. In some embodiments including an LCD display, the user interface may include a charge value and/or status icons, such as battery bars. Similarly, the power supply status data may be transmitted to the computing device to be displayed in the IFC control user interface **200** (e.g., the software application).

[0149] As detailed above, in some example embodiments, the food packages **70** may include an identifier **71** and the IFC **30** may include an identifier reader **45**. In some such embodiments, a PUS may associate the identifier with a food product of an order, such as by printing a label including the identifier **71** that is then affixed to the food package **70**. Additionally or alternatively, the identifier may be embedded or printed on the food package. In some example embodiments, the PUS or identifier reader associated with the POS may write identifier data to the identifier **71**. The identifier data may include, for example, the food product or type of food product, a target temperature (or temperature band) for the food product, a delivery location, an order number and/or inventory, or other useful data.

[0150] In some example embodiments, the identifier reader **45** may be configured to read the identifiers **71** associated with the food packages **70** as the food packages are placed within the food chamber **34**. For example, labels, such as barcodes, QR codes, and character codes, may be read as the products are placed within the food chamber by an identifier reader **45** disposed in the top wall **32**. In some example embodiments in which the identifier reader **45** is an RFID reader, the identifier reader may periodically interrogate identifiers **71**, e.g. RFID tags, within the food chamber. The RFID reader may be disposed in any of the insulated walls, for example the bottom wall **32**B between power supplies **40**. The identifier reader **45** may communicate the identification data to processing circuitry **42**.

[0151] Processing circuitry **42** may be configured to, in some embodiments, determine an order status based on the identification data. The processing circuitry **42** may receive an order inventory from the POS or as a portion of the identification data. The processing circuitry may compare the food products identified in the identification data to the inventory list to determine if the order status is complete or incomplete. The processing circuitry **42** may transit the order status to the POS (or other remote computing device) for display. Additionally or alternatively, the processing circuitry **42** may cause the user interface **52** of the IFC **30** to indicate the order status, such as illuminating a green LED for the order being complete or a red LED for the order being incomplete.

[0152] In some example embodiments, the processing circuitry **42** may be configured to determine a target temperature or target temperature band based on the identification data. As discussed above, the identification data may include the target temperature or temperature band. Additionally or alternatively, the identification data may include a temperature identifier or food product identifier. The processing circuitry **42** may be configured to access a temperature look up table, such as stored in memory, and determine the target temperature or temperature band based on the temperature identifier or food product identifier. In response to determining the target temperature or temperature band, the processing circuitry **42** may cause the IFC **30** to control the electrical power supplied to at least one of the fan **38** or the heating/cooling element, so as to cause the temperature of the food chamber to stay at the target temperature or within the temperature band.

[0153] In some example embodiments, the identifier reader **45** may also be configured to write information to the identifier **71** associated with the food package **70**. For example, the identifier reader **45** may write a target temperature or temperature band, an actual temperature, a time placed within the food chamber, or the like to an identifier **71** associated with one or more of the food packages **70** within the food chamber **34**. In such an example configuration, the identifier **71** may carry some such information that can be accessed by a customer to determine or track such various information about the food package. For example, a customer may be able to verify that the food package maintained a certain temperature during delivery.

[0154] In some example embodiments, the IFCs **30** may be configured to be remotely deactivated. Such a remote deactivation may occur from a remote server or through the above described software application. In some embodiments, the IFCs may be subject to a subscription service that enables use of the IFC for subscribers. In some cases of delinquent payment or shutting off of the subscription, a remote server may be configured to remotely deactivate the IFC (or certain functionality of the IFC). Additional example events that may warrant remote shut off may include theft or being lost, among others. In some such embodiments, a computing device may receive a user input identifying an IFC **30** to deactivate. The computing device may transmit a deactivation request to the identified IFC **30**. The processing circuitry **42** of the IFC **30** may then cause electrical power from the power supply **40** to be disabled to the fan **38** and/or heating/cooling element, such that the IFC **30** does not maintain a target temperature. Additionally or alternatively, other IFC features may be disabled including the beacon, power supply charging, identifier reading, or the like.

Example System Architecture

[0155] FIGS. **16-17** illustrate example systems/environments in which some example embodiments of the present invention may be employed. The system may include one or more user devices **310**, IFCs **311**, Point-of-Sale (POS) devices **312**, servers **313**, or customer devices **314**. Each one of the user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** may include or otherwise be embodied as a computing device (e.g. a computer, a network access terminal, a personal digital assistant (PDA), tablet computer, wearable computer, smart phone, or the like) capable of communication with a network **316**. As such, for example, each one of the user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** may include (or otherwise have access to) memory for storing instructions or applications for the performance of various

functions described herein and a corresponding processor or processing circuitry **320** for executing stored instructions or applications described herein. Each one of the user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** may also include software and/or corresponding hardware for enabling the performance of the respective functions of system, as described herein.

[0156] In some example embodiments, one or more of the user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** may include a client application configured to operate in accordance with an example embodiment of the present invention. In this regard, for example, the client application may include software for enabling a respective one of the user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** to communicate with the network **316** for requesting and/or receiving information and/or services via network **316**. Moreover, in some embodiments, the information or services that are requested via the network may be provided in software as a service (SAAS) environment. The information or services receivable at the client applications may include deliverable components (e.g. downloadable software to configure the user device **310**, or information for consumption/processing at the user device **310**).

[0157] Network **316** may be a data network, such as a local area network (LAN), a metropolitan area network (MAN), a wide area network (WAN) (e.g. the Internet), and/or the like, which may couple user device **310** to devices such as processing elements (e.g. personal computers, server computers, or the like) and/or databases. Communication between network **316**, user device **310** and the devices or databases (e.g. servers) to which user device **310** are coupled may be accomplished by either wireline or wireless communication mechanisms and corresponding communication protocols.

[0158] In some example embodiments, devices to which user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** may be coupled via network **316** may include one or more servers, e.g. application servers **318** and/or database servers **319**. It is noted that the example embodiment of the system discussed herein is scalable to inclusion of any number of user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314**. Although application server **318** and database server **319** are each referred to as "servers," this does not necessarily imply that they are embodied on separate servers or devices. As such, for example, a single server or device may include both entities and database server **319** could merely be represented by a database or group of databases physically located on the same server or device as application server **318**.

[0159] Application server **318** and database server **319** may each include hardware and/or software for configuring application server **318** and database server **319**, respectively, to perform various functions. As such, for example, application server **318** may include processing circuitry **320**, including a processor and memory enabling application server **318** to access and/or execute stored computer readable instructions for performing various functions. In an example embodiment, one function that may be provided by application server **318** may be the provision of access to information and/or services related to operation of the terminals or computers with which user device **310** is associated. For example, application server **318** may be configured to provide for storage of information descriptive of food temperatures, delivery routes, delivery locations, or the like. In some cases, such contents may be stored in database server **319**. Alternatively or additionally, application server **318** may be configured to provide analytical tools for use by the user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** in accordance with example embodiments.

[0160] In some embodiments, for example, application server **318** may therefore include an instance of an IFC module **332**, such as shown in FIG. **17**, comprising stored instructions for handling activities associated with practicing example embodiments as described herein. As such, in some embodiments, user devices **310**, IFCs **311**, or POS devices **312** may access the IFC module **332** online and utilize the services provided thereby. However, it should be appreciated that in other embodiments, IFC module **332** may be provided from application server **318** (e.g. via download over network **316**) to one or more of the user devices **310**, IFCs **311**, or POS devices **312** to enable recipient use devices to instantiate an instance of IFC module **332** for local operation. As yet another example, IFC module **332** may be instantiated at one or more of the user devices **310**, IFCs **311**, or POS devices **312** responsive to downloading instructions from a removable or transferable memory device carrying instructions for instantiating IFC module **332** at the corresponding one or more of the user devices **310**, IFCs **311**, or POS devices **312**. In such an example, network **316** may, for example, be a peer-to-peer (P2P) network where one of the user devices includes an instance of the IFC module **332** to enable the corresponding one of the user devices to act as a server to other user devices **310**, IFCs **311**, or POS devices **312**. In a further example embodiment, IFC module **332** may be distributed amongst one or more user devices **310**, IFCs **311**, POS devices **312**, IFC server **313**, and/or application server **318**.

[0161] In some example embodiments, application server **318** may include or have access to memory (e.g. internal memory or database server **319**) for storing instructions or applications for the performance of various functions and a corresponding processor for executing stored instructions or applications. For example, the memory may store an instance of an IFC module **332** configured to operate in accordance with various example embodiments of the present invention. In this regard, for example, the IFC module **332** may include software for enabling application server **318** to communicate with network **316**, user devices **310**, IFCs **311**, POS devices **312**, servers **313**, or customer devices **314** for the provision and/or receipt of information associated with performing activities as described herein. Moreover, in some embodiments, application server **318** may include or otherwise be in communication with an access terminal (e.g. a computer including a user interface) via which a user may interact with, configure, or otherwise maintain the system.

[0162] In some example embodiments, with reference to FIG. **17**, the IFC may include or otherwise be in communication with processing circuitry **320** that is configured to perform data processing, application execution and other processing and management services according to various example embodiments of the present invention. In some embodiments, processing circuitry **320** may include a memory **324** and a processor **322** that may be in communication with or otherwise control a user interface **326** and a communication interface **328**. As such, processing cir-

cuitry **320** may be embodied as a circuit chip (e.g. an integrated circuit chip) configured (e.g. with hardware, software or a combination of hardware and software) to perform operations described herein. However, in some embodiments, processing circuitry **320** may be embodied as a portion of a server, computer, laptop, workstation or even one of various mobile computing devices. In situations where processing circuitry **320** is embodied as a server or at a remotely located computing device, user interface **326** may be disposed at another device (e.g. at a computer terminal or client device) that may be in communication with processing circuitry **320** via the device interface **328** and/or a network (e.g. network **316**).

[0163] In some example embodiments, processor **322** (or processing circuitry **320**) may be embodied as, include, or otherwise control the IFC module **332**. Accordingly, the IFC module **332** may be any device or circuitry operating in accordance with software or otherwise embodied in hardware or a combination of hardware and software (e.g. processor **322** operating under software control, processor **322** embodied as an ASIC or FPGA specifically configured to perform the operations described herein, or a combination thereof) thereby configuring the device or circuitry to perform the corresponding functions of IFC module **332**, as described herein.

[0164] Processor **322** may be embodied in a number of different ways. For example, processor **322** may be embodied as various processing means such as a microprocessor or other processing element, a coprocessor, a controller or various other computing or processing devices including integrated circuits such as, for example, an ASIC (application specific integrated circuit), an FPGA (field programmable gate array), a hardware accelerator, or the like. In some example embodiments, processor **322** may be configured to execute instructions stored in the memory **324** or otherwise accessible to processor **322**. As such, whether configured by hardware or software methods, or by a combination thereof, processor **322** may represent an entity (e.g. physically embodied in circuitry) capable of performing operations according to embodiments of the present invention while configured accordingly. Thus, for example, when processor **322** is embodied as an ASIC, FPGA or the like, processor **322** may be specifically configured hardware for conducting the operations described herein. Alternatively, as another example, when processor **322** is embodied as an executor of software instructions, the instructions may specifically configure processor **322** to perform the operations described herein.

[0165] In some example embodiments, the memory **324** may include one or more non-transitory storage or memory devices such as, for example, volatile and/or non-volatile memory that may be either fixed or removable. Memory **324** may be configured to store information, data, applications, instructions or the like for enabling the apparatus to carry out various functions in accordance with example embodiments of the present invention. For example, memory **324** could be configured to buffer input data for processing by processor **322**. Additionally or alternatively, memory **324** could be configured to store instructions for execution by processor **322**. As yet another alternative, memory **324** may include one of a plurality of databases (e.g. database server **319**) that may store a variety of files, contents or data sets. Among the contents of memory **324**, applications (e.g. client applications or service application) may be stored for execution by processor **322** in order to carry out the functionality associated with each respective application.

[0166] User interface **326** may be an input/output device for receiving instructions directly from a user. User interface **326** may be in communication with processing circuitry **320** to receive user input via user interface **326** and/or to present output to a user as, for example, audible, visual, mechanical or other output indications. User interface **326** may include, for example, a keyboard, a mouse, a joystick, a display (e.g. a touch screen display), one or more indicators (e.g. LEDs), a microphone, a speaker, or other input/output mechanisms. Further, processing circuitry **320** may comprise, or be in communication with, user interface circuitry configured to control at least some functions of one or more elements of user interface **326**. Processing circuitry **320** and/or user interface circuitry may be configured to control one or more functions of one or more elements of user interface **326** through computer program instructions (e.g. software and/or firmware) stored on a memory device accessible to processing circuitry **320** (e.g. volatile memory, non-volatile memory, and/or the like). In some example embodiments, the user interface circuitry is configured to facilitate user control of at least some functions of the apparatus through the use of a display configured to respond to user inputs. Processing circuitry **320** may also comprise, or be in communication with, display circuitry configured to display at least a portion of user interface **326**. In such a regard, the display and the display circuitry may be configured to facilitate user control of at least some functions of the IFC.

[0167] Communication interface **328** may be any device or circuitry embodied in either hardware, software, or a combination of hardware and software that is configured to receive and/or transmit data from/to a network and/or any other device or module in communication with the apparatus. Communication interface **328** may also include, for example, an antenna (or multiple antennas) and supporting hardware and/or software for enabling communications with network **316** or other devices (e.g. user device **310**). In some environments, communication interface **328** may alternatively or additionally support wired communication. As such, for example, communication interface **328** may include a communication modem and/or other hardware/software for supporting communication via cable, digital subscriber line (DSL), universal serial bus (USB) or other mechanisms. In some embodiments, communication interface **328** may support communication via one or more different communication protocols or methods. In some cases, IEEE 802.15.4 based communication techniques such as ZigBee or other low power, short range communication protocols, such as a proprietary technique based on IEEE 802.15.4 may be employed along with radio frequency identification (RFID) or other short range communication techniques (e.g., Bluetooth).

[0168] In some example embodiments, the processing circuitry **320** may include or be in communication with a temperature sensor **340**. The temperature sensor **340** may be configured to measure the air temperature of a food chamber of an IFC **311**. The temperature sensor **340** may include a thermocouple, a thermistor, a resistance thermometer, or any other suitable temperature measurement sensor.

[0169] In some example embodiments, the processing circuitry **320** may include or be in communication with a humidity sensor **342**. The humidity sensor **342** may be configured to measure the humidity of a volume of air in a

food chamber of an IFC **311**. The humidity sensor **342** may be a capacitive sensor, a resistive sensor, or a thermal conductivity sensor, or other suitable humidity measuring sensor.

[0170] In some example embodiments, the processing circuitry **320** may include or be in communication with a position sensor **344**. The position sensor **344** may be configured to measure one or more values for a location determination. The position sensor **344** may include a global position system (GPS) sensor, radio frequency identification (RFID) sensor, cellular signal sensor, or other suitable sensor for location determination or location based service (LBS).

[0171] In some example embodiments, the processing circuitry **320** may include or be in communication with a temperature element **350**. The temperature element **350** may be configured to provide heat, cooling, or both to control the temperature of the food chamber to maintain a predetermined temperature or predetermined temperature band. In some example embodiments, the temperature element **350** may include a heating element, such as a resistive coil, a silicone heat pad, or other suitable heat source. In some example embodiments, the temperature element **350** may include a cooling element, such as a refrigeration unit. In some example embodiments, the temperature element **350** comprises both a heating element and cooling element. For example, the temperature element **350** may include both a resistive coil and a refrigeration unit. In some example embodiments, the temperature element **350** may comprise a thermoelectric generator (TEG) configured to provide both heating and cooling based on the direction of current flow through the TEG.

[0172] In some example embodiments, the processing circuitry **320** may include or be in communication with a fan **352**. The fan **352** may circulate air within the food delivery container such as through the climate control system into the food chamber. The fan may be an axial flow fan, a centrifugal fan (e.g. blower), or a cross-flow fan.

[0173] In some example embodiments, the processing circuitry **320** may include or be in communication with a power supply **354**. The power supply **354** may provide electrical power to the processing circuitry **320**, the fan **352**, the temperature element **350**, or the like. The power supply **354** may be a rechargeable power supply including without limitation a rechargeable battery, such as cylindrical batteries or flat pack batteries, a capacitor, such as a super capacitor, or other suitable power source.

[0174] In some example embodiments, the processing circuitry **320** may include or be in communication with a humidity control element **156**, such as a flow valve in communication with a humidity element. In such an example embodiment, the flow valve may be configured to enable or limit air flow to, or through, a humidity element. In an example embodiment, a flow valve may be a louver, or other suitable air flow restrictor.

[0175] In some example embodiments, the processing circuitry **320** may include or be in communication with an identifier (ID) reader **358**. The identifier reader **358** may include a barcode reader, quick response (QR) code reader, a character reader, an RFID reader, an energy quality reader (e.g., a device for metering and measuring electrical energy quality) or the like. The identifier reader **358** may be configured to read an identifier or other data associated with one or more food packages placed into the food chamber. In some example embodiments, the identifier reader **358** may also be configured to write information to the identifier associated with the food package, such as a target temperature, an actual temperature, a time placed within the food chamber, among other things, such as described herein.

[0176] IFC module **332** may include tools to facilitate food delivery monitoring and control via network **316**. In some example embodiments, IFC module **332** may be configured to receive temperature data indicative of the internal temperature of a food chamber of one or more IFCs **311** and control, for at least one IFC **311**, the electrical power supplied to at least one of a fan **352** or a temperature element **350** to maintain a temperature of the food chamber, such as described herein.

[0177] Further examples of various functions and embodiments are illustrated by the systems/environments shown in FIGS. **16** and **17**. In this regard, the IFC and the various contemplated devices and servers may interact and communicate as needed to facilitate the various contemplated functions described herein.

[0178] As an example, in some embodiments, a third-party user device, such as a smartphone of a delivery driver may be utilized for certain functionality of the IFC. For example, instead of utilizing a position sensor **344** on the IFC, the third-party user device **310***a* may include a position sensor **399** that can be utilized for various features, such as boost mode or beacon mode. In this regard, the position sensor on the smartphone of the delivery driver may be leveraged (which may allow removal or non-inclusion of the position sensor **344**—such as to reduce costs). In some embodiments, both position sensors may be utilized to enable confirmation of location. In some embodiments, the third-party user device **310** may run various software applications, such as the software application described with respect to FIGS. **15**A-**15**C. In some embodiments, certain functionality of the software application may be enabled or disabled for a smartphone application on the third-party user device **310***a*. Further, in some embodiments, the third-party user device **310***a* may communicate directly (such as through Bluetooth or other communication mode) with the IFC.

[0179] As another example, a restaurant user device **310***b* may utilize various functionality described herein, such as the software application described with respect to FIGS. **15**A-**15**C. Further, the restaurant user device **310***b* may communicate, in some embodiments, directly (such as through Bluetooth or other communication mode) with a point of sale module **312**, such as to facilitate various functionality—such as order completion checking or preheating functionality.

[0180] As a further example, a customer user device **314** may be an example end user's device, such as the smartphone of a person ordering food. One or more of the IFC, third-party user device **310***a*, restaurant user device **310***b*, point of sale module **312**, or server **313** may communicate with the customer user device **314** to provide information regarding the delivery or order (e.g., updates on the order status, estimated delivery time, etc.).

[0181] As yet another example, a server **313** may interact with one or more of the devices/modules/systems to facilitate various functionality described herein. For example, the server **313** may enable or disable operations, such certain features facilitated by the software application or directly on the IFC—such as in response to termination of a subscription.

Example Flowcharts

[0182] FIGS. **18-22** illustrate flowcharts corresponding to various functions and/or methods of various example embodiments of the present invention, such as described herein. In some embodiments, processing circuitry **320** (which may include a processor capable of executing instructions stored in a non-transitory computer readable medium/memory) may be configured to implement various control algorithms corresponding to such flowcharts, or portions thereof.

[0183] With reference to FIG. **18**, an example method **400** for controlling an IFC may include determining a first temperature or temperature band for maintaining the food chamber at operation **402**. Then, at operation **404**, the method may include receiving temperature data from the temperature sensor configured to measure a temperature of a food chamber of the food delivery container. Further, the method may include controlling the electrical power supplied to the fan or the temperature element to maintain the temperature of the food chamber at the first temperature or within the first predetermined temperature band at operation **406**.

[0184] In some embodiments, the method may include additional, optional operations, and/or the operations described above may be modified or augmented. Some examples of modifications, optional operations, and augmentations are described below, as indicated by dashed lines, such as, determining a current location based on position data received from the position sensor at operation **408**, determine a delivery location at operation **410**. The method may also include generating a boost request in response to the current location being within a predetermined threshold distance from the delivery location at operation **412**, causing the boost request to be transmitted to the food delivery container at operation **414**, and controlling the electrical power supplied to the fan or the temperature element to maintain the temperature of the fbod chamber at a second temperature or within a second temperature band at operation **415**. The method may further include generating a beacon request in response to the current location being within a predetermined threshold distance from the delivery location at operation **416**, transmitting the beacon request to the food delivery container at operation **418**, and causing a user interface to generate an audio or visual alert at operation **420**. The method may also include receiving user input a target temperature or temperature band at operation **422**, and causing a current temperature based on the temperature data to be displayed on a user interface at operation **424**. In some example embodiments, the method includes receiving a user input defining a beacon request at operation **428**, and receiving a user input defining a boost request at operation **430**.

[0185] With reference to FIG. **19**, an example method **431** for determining and/or controlling humidity in the IFC is shown. The method may include receiving humidity data from the humidity sensor at operation **432**, comparing the humidity data to one or more humidity thresholds at operation **434**, causing a humidity control request to be transmitted to the food delivery container at operation **436**, and causing a flow valve to be opened when the humidity data exceeds the one or more humidity thresholds or be closed when the humidity data does not exceed the one or more humidity thresholds at operation **438**. In some embodiments, the method includes causing a current humidity based on the humidity data to be displayed on the user interface at operation **440**.

[0186] With reference to FIG. **20**, an example method **441** for determining and/or displaying a power supply status for an IFC is shown. The method may include determining a power supply status at operation **442**, receiving an indication of a power supply status from the food delivery container at operation **444**, and causing an indication of the power supply status to be displayed on a user interface at operation **446**.

[0187] With reference to FIG. **21**, an example method **447** for determining and/or pre-heating or pre-cooling an IFC is shown. The method may include receiving a user input defining a food product at operation **448**, determining a food delivery container based on a food size and/or other factors associated with the food product at operation **449**, determining a first temperature band or temperature based on the food product at operation **450**, determining an estimated completion time for completing the food product at operation **452**, and causing the food delivery container to control the electrical power supplied to at least one of the fan or the temperature element, such that the temperature of the food chamber is within the first temperature band or at the first temperature at the estimated completion time at operation **454**. In some example embodiments, the method may include receiving a user input defining a first temperature band or first temperature at operation **456** and receiving a user input defining an estimated completion time at operation **458**.

[0188] In some example embodiments, the method may include determining that the first temperature or first temperature band has been reached inside the food chamber at operation **480** and causing an alert or notification indicating that pre-heating has completed at operation **482**. In some such embodiments, the method may not include determining an estimated completion time and, instead, may just indicate when the pre-heating is complete. Depending on the configuration of the systems, the alert or notification may include any alert or notification (such as on the IFC directly, through the software application, or otherwise). For example, an LED may illuminate on the IFC to indicate which IFC is pre-heated and ready for insertion of the order.

[0189] With reference to FIG. **22**, an example method **490** for utilizing an identifier reader with an IFC is shown. The method may include receiving identification data from the identifier reader at operation **456**, determining an order status based on the identification data at operation **458**, causing a user interface associated with the food delivery container to indicate the order status at operation **460**, and/or causing the order status to be transmitted to a remote computing device at operation **462**. In some example embodiments, the method may include determining a first temperature or temperature band based on the identification data at operation **464** and causing the food delivery container to control the electrical power supplied to at least one of the fan or the temperature element, such that the temperature of the food chamber is maintained at the first temperature or within the first temperature band at operation **466**. In some example embodiments, the method may include writing information to the identifier at operation **468**.

CONCLUSION

[0190] Many modifications and other embodiments of the inventions set forth herein may come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the embodiments of the invention are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the invention. Moreover, although the foregoing descriptions and the associated drawings describe example embodiments in the context of certain example combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the invention. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated within the scope of the invention. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

1. A food delivery container comprising:

a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber; and

a climate control system positioned within one of the plurality of insulated walls, wherein the climate control system comprises:

an air flow pathway;

a temperature control element positioned within the air flow pathway;

a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls, wherein the fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the temperature control element to circulate temperature controlled air within the food delivery container; and

a power supply configured to supply electrical power to the fan and the temperature control element.

2. The food delivery container of claim **1** further comprising:

a temperature sensor configured to measure a temperature of the food chamber;

a processor; and

a memory including computer program code configured to cause the processor to:

receive temperature data from the temperature sensor; and

control the electrical power supplied to at least one of the fan or the temperature control element to maintain the temperature of the food chamber either at a first predetermined temperature or within a first predetermined temperature band.

3. The food delivery container of claim **2** further comprising:

a position sensor, and

wherein the computer program code is further configured to cause the processor to:

determine a current location based on position data received from the position sensor;

determine a delivery location;

compare the current location to the delivery location; and

in response to determining that the current location is within a predetermined threshold distance from the delivery location, control the electrical power supplied to at least one of the fan or the temperature control element to maintain the temperature of the food chamber either at a second predetermined temperature or within a second predetermined temperature band, wherein the second predetermined temperature band is higher than the first predetermined temperature band or the second predetermined temperature is higher than the first predetermined temperature.

4. The food delivery container of claim **2**, wherein the computer program code is further configured to cause the processor to:

receive a boost request from a remote computing device; and

control the electrical power supplied to at least one of the fan or the temperature control element to maintain the temperature of the food chamber either at a second predetermined temperature or within a second predetermined temperature band, wherein the second predetermined temperature band is higher than the first predetermined temperature band or the second predetermined temperature is higher than the first predetermined temperature.

5. The food delivery container of claim **2**, wherein the computer program code is further configured to cause the processor to:

receive a user input defining a food product;

determine the first predetermined temperature or the first predetermined temperature band based on the food product;

control the electrical power supplied to at least one of the fan or the temperature control element such that the temperature of the food chamber is either brought to or maintained at the first predetermined temperature or within the first predetermined temperature band; and

cause, in response to determining that the temperature of the food chamber has reached the first predetermined temperature or the first predetermined temperature band, an alert or notification to indicate that the temperature of the food chamber has reached the first predetermined temperature or the first predetermined temperature band.

6. The food delivery container of claim **2**, wherein the computer program code is further configured to cause the processor to:

receive a user input defining the first predetermined temperature or the first predetermined temperature band;

determine an estimated completion time corresponding to when the food product will be ready for placement into the food chamber; and

control the electrical power supplied to at least one of the fan or the temperature control element such that the temperature of the food chamber is either at the first

predetermined temperature or within the first predetermined temperature band at the estimated completion time.

7. The food delivery container of claim **1** further comprising:

a position sensor, and

wherein the computer program code is further configured to cause the processor to:

determine a current location based on position data received from the position sensor;

determine a delivery location;

compare the current location to the delivery location; and

in response to determining that the current location is within a predetermined threshold distance from the delivery location, cause a user interface of the food delivery container to generate an audio or visual alert.

8. (canceled)

9. The food delivery container of claim **1** further comprising:

a processor; and

a memory including computer program code configured to cause the processor to:

receive a beacon request from a remote computing device; and

cause a user interface of the food delivery container to generate an audio or visual alert.

10. The food delivery container of claim **1**, wherein the power supply comprises a rechargeable battery or capacitor that is capable of being recharged and providing electrical power.

11.-**14**. (canceled)

15. The food delivery container of claim **1** further comprising:

at least one heat conductor configured to disperse heat generated by the temperature control element or the power supply.

16.-**20**. (canceled)

21. The food delivery container of claim **1** further comprising:

a humidity control element configured to remove or add humidity to a volume of air within the food chamber to maintain either a predetermined humidity level or a predetermined humidity band.

22.-**23**. (canceled)

24. The food delivery container of claim **1** further comprising:

a food package support configured to be inserted within the food chamber, wherein the food package support comprises a plurality of food package receptacles defined by a plurality of receptacle walls, wherein the plurality of receptacle walls comprises two side walls disposed on opposite sides of the food package support, an upper wall, and lower wall for each of the plurality of food package receptacles, wherein the upper walls and lower walls of the plurality of food package receptacles comprise at least one flow hole enabling air flow through the food package support.

25. The food delivery container of claim **24**, wherein the at least one flow hole is configured to be aligned with the first air outlet opening of the one of the plurality of insulated walls defining the food chamber.

26. The food delivery container of claim **24**, wherein the food package support further comprises a plurality of pinch slots, wherein the plurality of pinch slots are configured to engage a food package to limit opening of the food package when inserted into one of the plurality of food package receptacles.

27.-**31**. (canceled)

32. The food delivery container of claim **1** further comprising:

an identifier reader configured to read a food package identifier associated with one or more food packages placed within the food chamber;

a processor; and

a memory including computer program code configured to cause the processor to:

receive identification data from the identifier reader.

33. The food delivery container of claim **32**, wherein the computer program code is further configured to cause the processor to:

determine a first predetermined temperature or a first predetermined temperature band based on the identification data; and

cause the food delivery device to control the electrical power supplied to at least one of the fan or the temperature control element to maintain the temperature of the food chamber either at a first predetermined temperature or within a first predetermined temperature band.

34. The food delivery container of claim **32**, wherein the computer program code is further configured to cause the processor to:

determine an order status based on the identification data by comparing the identification data with a planned order, wherein the planned order includes required meal components corresponding to a customer order scheduled for delivery using the food delivery container.

35.-**37**. (canceled)

38. The food delivery container of claim **1** further comprising:

one or more wall projections extending from at least one of the plurality of insulated walls into the food chamber, wherein the one or more wall projections are configured to enable complementary food packaging to be placed into the food chamber and limit or prevent non-complementary food packaging from being placed into the food chamber.

39.-**41**. (canceled)

42. A system comprising:

a food delivery container comprising:

a plurality of insulated walls that form a food chamber, wherein at least one of the insulated walls is movable between a closed position and an open position to enable food to be placed within or removed from the food chamber;

a temperature sensor configured to measure a temperature of the food chamber; and

a climate control system positioned within one of the plurality of insulated walls, wherein the climate control system comprises:

an air flow pathway;

a temperature control element positioned within the air flow pathway;

a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls, wherein the fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the temperature control element to circulate temperature controlled air within the food delivery container; and

a power supply configured to supply electrical power to the fan and the temperature control element; and

an application module stored on a computing device, the computing device comprising:

a processor; and

a memory including computer program code configured to cause the processor to:

receive temperature data from the temperature sensor; and

cause the food delivery container to control the electrical power supplied to at least one of the fan or the temperature control element to maintain the temperature of the food chamber at a first predetermined temperature or within a first predetermined temperature band.

43. The system of claim **42**, wherein the computing device comprises a computing device that is separate from the food delivery container.

44. The system of claim **42**, wherein the computing device comprises a point of sale computing device.

45. The system of claim **42**, wherein the computing device comprises a mobile computing device.

46.-**48**. (canceled)

49. A method for controlling a food delivery container, the method comprising:

receiving temperature data from a temperature sensor configured to measure a temperature of a food chamber of the food delivery container, wherein the food delivery container comprises:

a plurality of insulated walls forming the food chamber, wherein at least one of the insulated walls is moveable between a closed position and an open position to enable food to be placed within or removed from the food chamber; and

a climate control system positioned within one of the plurality of insulated walls, wherein the climate control system comprises:

an air flow pathway

a temperature control element positioned within the air flow pathway;

a fan in air flow communication with the food chamber through a first inlet opening and a first outlet opening in the one of the plurality of insulated walls, wherein the fan is configured to draw in air from the food chamber through the first inlet opening and push air into the food chamber through the first outlet opening such that air travels through the air flow pathway and over the temperature control element to circulate temperature controlled air within the food delivery container; and

a power supply configured to supply electrical power to the fan and temperature control element: and

controlling the electrical power supplied to at least one of the fan or the temperature control element to maintain the temperature of the food chamber at a first predetermined temperature or within a first predetermined temperature band.

50.-**70**. (canceled)

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