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Pivoting camera assembly for a refrigerator appliance

Abstract

A refrigerator appliance includes a liner positioned within a cabinet and having an inner liner surface that defines a chilled chamber. A door is rotatably hinged to the cabinet to provide selective access to the chilled chamber and a camera assembly is mounted to the liner for monitoring the chilled chamber. The camera assembly includes a camera housing, a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation, and a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position.

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Background/Summary

FIELD OF THE INVENTION

(1) The present subject matter relates generally to refrigerator appliances, and more particularly inventory management systems and camera assemblies for use in a refrigerator appliance.

BACKGROUND OF THE INVENTION

(2) Refrigerator appliances generally include a cabinet that defines a chilled chamber for receipt of food articles for storage. In addition, refrigerator appliances include one or more doors rotatably hinged to the cabinet to permit selective access to food items stored in chilled chamber(s). The refrigerator appliances can also include various storage components mounted within the chilled chamber and designed to facilitate storage of food items therein. Such storage components can include racks, bins, shelves, or drawers that receive food items and assist with organizing and arranging of such food items within the chilled chamber.

(3) Notably, it is frequently desirable to have an updated inventory of items that are present within the refrigerator appliance, e.g., to facilitate reorders, to ensure food freshness or avoid spoilage, etc. Thus, it may be desirable to monitor food items that are added to or removed from the refrigerator appliance. Certain conventional refrigerator appliances include cameras to obtain images within the chilled chamber for display to the user. However, these cameras commonly have a fixed orientation and do not provide any means for a user to adjust the field of view or regions monitored by the

camera. Accordingly, such systems lack versatility, waste resources on imaging that is not useful, and may result in user dissatisfaction with the refrigerator appliance. Conventional camera systems may also be overly complex and costly.

(4) Accordingly, a refrigerator appliance with systems for improved inventory management would be useful. More particularly, a refrigerator appliance that includes a camera assembly that facilitates improved viewing and monitoring of inventory would be particularly beneficial.

BRIEF DESCRIPTION OF THE INVENTION

(5) Aspects and advantages of the invention will be set forth in part in the following description, or may be apparent from the description, or may be learned through practice of the invention.

(6) In one exemplary embodiment, a refrigerator appliance is provided including a cabinet, a liner positioned within the cabinet, the liner having an inner liner surface that defines a chilled chamber, a door being rotatably hinged to the cabinet to provide selective access to the chilled chamber, and a camera assembly mounted to the liner for monitoring the chilled chamber. The camera assembly includes a camera housing, a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation, and a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position.

(7) In another exemplary embodiment, a camera assembly for a refrigerator appliance is provided. The refrigerator appliance includes a liner positioned within a cabinet, the liner having an inner liner surface that defines a chilled chamber, and a door being rotatably hinged to the cabinet to provide selective access to the chilled chamber. The camera assembly includes a camera housing, a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation, and a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position.

(8) In another exemplary embodiment, an appliance is provided including a cabinet defining a chamber, a door rotatably hinged to the cabinet to provide selective access to the chamber, and a camera assembly mounted to the cabinet for monitoring the chamber. The camera assembly includes a camera housing, a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation, and a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position.

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

Description

BRIEF DESCRIPTION OF THE DRAWINGS

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

(2) FIG. **1** provides a perspective view of a refrigerator appliance according to an exemplary embodiment of the present subject matter.

(3) FIG. **2** provides a perspective view of the exemplary refrigerator appliance of FIG. **1**, with the doors of the fresh food chamber shown in an open position to reveal an inventory management system having a plurality of cameras according to an exemplary embodiment of the present subject

matter.
(4) FIG. **3** provides a perspective view of the fresh food chamber and a camera assembly of the exemplary refrigerator appliance of FIG. **1** according to an exemplary embodiment of the present subject matter.
(5) FIG. **4** provides a perspective view of a camera assembly that may be mounted on a sidewall of the exemplary refrigerator appliance of FIG. **1** according to an exemplary embodiment of the present subject matter.
(6) FIG. **5** provides a front view of the exemplary camera assembly of FIG. **4** according to an exemplary embodiment of the present subject matter.
(7) FIG. **6** provides a top, schematic view of the exemplary camera assembly of FIG. **4** when a door of the refrigerator appliance is open according to an exemplary embodiment of the present subject matter.
(8) FIG. **7** provides a top, schematic view of the exemplary camera assembly of FIG. **4** when the door of the refrigerator appliance is closed according to an exemplary embodiment of the present subject matter.
(9) FIG. **8** provides a perspective view of a camera assembly that may be mounted on a top wall of the exemplary refrigerator appliance of FIG. **1** according to an exemplary embodiment of the present subject matter.
(10) FIG. **9** provides a side view of the exemplary camera assembly of FIG. **8** according to an exemplary embodiment of the present subject matter.
(11) Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

DETAILED DESCRIPTION

(12) Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.
(13) As used herein, the terms “first,” “second,” and “third” may be used interchangeably to distinguish one component from another and are not intended to signify location or importance of the individual components. The terms “upstream” and “downstream” refer to the relative flow direction with respect to fluid flow in a fluid pathway. For example, “upstream” refers to the flow direction from which the fluid flows, and “downstream” refers to the flow direction to which the fluid flows. The terms “includes” and “including” are intended to be inclusive in a manner similar to the term “comprising.” Similarly, the term “or” is generally intended to be inclusive (i.e., “A or B” is intended to mean “A or B or both”).
(14) Approximating language, as used herein throughout the specification and claims, is applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as “about,” “approximately,” and “substantially,” are not to be limited to the precise value specified. In at least some instances, the approximating language may correspond to the precision of an instrument for measuring the value. For example, the approximating language may refer to being within a 10 percent margin.
(15) Referring now to the figures, an exemplary appliance will be described in accordance with exemplary aspects of the present subject matter. Specifically, FIG. **1** provides a perspective view of an exemplary refrigerator appliance **100** and FIG. **2** illustrates refrigerator appliance **100** with some of the doors in the open position. As illustrated, refrigerator appliance **100** generally defines a

vertical direction V, a lateral direction L, and a transverse direction T, each of which is mutually perpendicular, such that an orthogonal coordinate system is generally defined.

(16) According to exemplary embodiments, refrigerator appliance **100** includes a cabinet **102** that is generally configured for containing and/or supporting various components of refrigerator appliance **100** and which may also define one or more internal chambers or compartments of refrigerator appliance **100**. In this regard, as used herein, the terms "cabinet," "housing," and the like are generally intended to refer to an outer frame or support structure for refrigerator appliance **100**, e.g., including any suitable number, type, and configuration of support structures formed from any suitable materials, such as a system of elongated support members, a plurality of interconnected panels, or some combination thereof. It should be appreciated that cabinet **102** does not necessarily require an enclosure and may simply include open structure supporting various elements of refrigerator appliance **100**. By contrast, cabinet **102** may enclose some or all portions of an interior of cabinet **102**. It should be appreciated that cabinet **102** may have any suitable size, shape, and configuration while remaining within the scope of the present subject matter.

(17) As illustrated, cabinet **102** generally extends between a top **104** and a bottom **106** along the vertical direction V, between a first side **108** (e.g., the left side when viewed from the front as in FIG. **1**) and a second side **110** (e.g., the right side when viewed from the front as in FIG. **1**) along the lateral direction L, and between a front **112** and a rear **114** along the transverse direction T. In general, terms such as "left," "right," "front," "rear," "top," or "bottom" are used with reference to the perspective of a user accessing appliance **102**.

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

(19) Refrigerator doors **128** are rotatably hinged to an edge of housing **102** for selectively accessing fresh food chamber **122**. In addition, a freezer door **130** is arranged below refrigerator doors **128** for selectively accessing freezer chamber **124**. Freezer door **130** is coupled to a freezer drawer (not shown) slidably mounted within freezer chamber **124**. In general, refrigerator doors **128** form a seal over a front opening **132** defined by cabinet **102** (e.g., extending within a plane defined by the vertical direction V and the lateral direction L). In this regard, a user may place items within fresh food chamber **122** through front opening **132** when refrigerator doors **128** are open and may then close refrigerator doors **128** to facilitate climate control. Refrigerator doors **128** and freezer door **130** are shown in the closed configuration in FIG. **1**. One skilled in the art will appreciate that other chamber and door configurations are possible and within the scope of the present invention.

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

(21) Referring again to FIG. **1**, a dispensing assembly **140** will be described according to

exemplary embodiments of the present subject matter. Although several different exemplary embodiments of dispensing assembly **140** will be illustrated and described, similar reference numerals may be used to refer to similar components and features. Dispensing assembly **140** is generally configured for dispensing liquid water and/or ice. Although an exemplary dispensing assembly **140** is illustrated and described herein, it should be appreciated that variations and modifications may be made to dispensing assembly **140** while remaining within the present subject matter.

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

(23) Dispensing assembly **140** includes an ice dispenser **144** including a discharging outlet **146** for discharging ice from dispensing assembly **140**. An actuating mechanism **148**, shown as a paddle, is mounted below discharging outlet **146** for operating ice or water dispenser **144**. In alternative exemplary embodiments, any suitable actuating mechanism may be used to operate ice dispenser **144**. For example, ice dispenser **144** can include a sensor (such as an ultrasonic sensor) or a button rather than the paddle. Discharging outlet **146** and actuating mechanism **148** are an external part of ice dispenser **144** and are mounted in dispenser recess **142**. By contrast, refrigerator door **128** may define an icebox compartment **150** (FIG. **2**) housing an icemaker and an ice storage bin (not shown) that are configured to supply ice to dispenser recess **142**.

(24) A control panel **152** is provided for controlling the mode of operation. For example, control panel **152** includes one or more selector inputs **154**, such as knobs, buttons, touchscreen interfaces, etc., such as a water dispensing button and an ice-dispensing button, for selecting a desired mode of operation such as crushed or non-crushed ice. In addition, inputs **154** may be used to specify a fill volume or method of operating dispensing assembly **140**. In this regard, inputs **154** may be in communication with a processing device or controller **156**. Signals generated in controller **156** operate refrigerator appliance **100** and dispensing assembly **140** in response to selector inputs **154**. Additionally, a display **158**, such as an indicator light or a screen, may be provided on control panel **152**. Display **158** may be in communication with controller **156**, and may display information in response to signals from controller **156**.

(25) As used herein, “processing device” or “controller” may refer to one or more microprocessors or semiconductor devices and is not restricted necessarily to a single element. The processing device can be programmed to operate refrigerator appliance **100**, dispensing assembly **140** and other components of refrigerator appliance **100**. The processing device may include, or be associated with, one or more memory elements (e.g., non-transitory storage media). In some such embodiments, the memory elements include electrically erasable, programmable read only memory (EEPROM). Generally, the memory elements can store information accessible by a processing device, including instructions that can be executed by processing device. Optionally, the instructions can be software or any set of instructions and/or data that when executed by the processing device, cause the processing device to perform operations.

(26) Referring still to FIG. **1**, a schematic diagram of an external communication system **170** will be described according to an exemplary embodiment of the present subject matter. In general, external communication system **170** is configured for permitting interaction, data transfer, and other communications between refrigerator appliance **100** and one or more external devices. For example, this communication may be used to provide and receive operating parameters, user instructions or notifications, performance characteristics, user preferences, or any other suitable information for improved performance of refrigerator appliance **100**. In addition, it should be

appreciated that external communication system **170** may be used to transfer data or other information to improve performance of one or more external devices or appliances and/or improve user interaction with such devices.

(27) For example, external communication system **170** permits controller **156** of refrigerator appliance **100** to communicate with a separate device external to refrigerator appliance **100**, referred to generally herein as an external device **172**. As described in more detail below, these communications may be facilitated using a wired or wireless connection, such as via a network **174**. In general, external device **172** may be any suitable device separate from refrigerator appliance **100** that is configured to provide and/or receive communications, information, data, or commands from a user. In this regard, external device **172** may be, for example, a personal phone, a smartphone, a tablet, a laptop or personal computer, a wearable device, a smart home system, or another mobile or remote device.

(28) In addition, a remote server **176** may be in communication with refrigerator appliance **100** and/or external device **172** through network **174**. In this regard, for example, remote server **176** may be a cloud-based server **176**, and is thus located at a distant location, such as in a separate state, country, etc. According to an exemplary embodiment, external device **172** may communicate with a remote server **176** over network **174**, such as the Internet, to transmit/receive data or information, provide user inputs, receive user notifications or instructions, interact with or control refrigerator appliance **100**, etc. In addition, external device **172** and remote server **176** may communicate with refrigerator appliance **100** to communicate similar information. According to exemplary embodiments, remote server **176** may be configured to receive and analyze images obtained by camera assembly **200**, e.g., to facilitate inventory analysis.

(29) In general, communication between refrigerator appliance **100**, external device **172**, remote server **176**, and/or other user devices or appliances may be carried using any type of wired or wireless connection and using any suitable type of communication network, non-limiting examples of which are provided below. For example, external device **172** may be in direct or indirect communication with refrigerator appliance **100** through any suitable wired or wireless communication connections or interfaces, such as network **174**. For example, network **174** may include one or more of a local area network (LAN), a wide area network (WAN), a personal area network (PAN), the Internet, a cellular network, any other suitable short- or long-range wireless networks, etc. In addition, communications may be transmitted using any suitable communications devices or protocols, such as via Wi-Fi®, Bluetooth®, Zigbee®, wireless radio, laser, infrared, Ethernet type devices and interfaces, etc. In addition, such communication may use a variety of communication protocols (e.g., TCP/IP, HTTP, SMTP, FTP), encodings or formats (e.g., HTML, XML), and/or protection schemes (e.g., VPN, secure HTTP, SSL).

(30) External communication system **170** is described herein according to an exemplary embodiment of the present subject matter. However, it should be appreciated that the exemplary functions and configurations of external communication system **170** provided herein are used only as examples to facilitate description of aspects of the present subject matter. System configurations may vary, other communication devices may be used to communicate directly or indirectly with one or more associated appliances, other communication protocols and steps may be implemented, etc. These variations and modifications are contemplated as within the scope of the present subject matter.

(31) Referring now generally to FIG. **2**, refrigerator appliance **100** may further include an inventory management system **180** that is generally configured to monitor one or more chambers of refrigerator appliance **100**, e.g., to monitor the addition or removal of inventory. More specifically, as described in more detail below, inventory management system **180** may include a plurality of sensors, cameras, or other detection devices that are used to monitor fresh food chamber **122** to detect objects (e.g., identified generally by reference numeral **182**) that are positioned in or removed from fresh food chamber **122**. In this regard, inventory management system **180** may use

data from each of these devices to obtain a complete representation or knowledge of the identity, position, and/or other qualitative or quantitative characteristics of objects **182** within fresh food chamber **122**. Although inventory management system **180** is described herein as monitoring fresh food chamber **122** for the detection of objects **182**, it should be appreciated that aspects of the present subject matter may be used to monitor objects or items in any other suitable appliance, chamber, etc.

(32) As shown schematically in FIG. **2**, inventory management system **180** may include one or more camera assemblies **200** that are generally positioned and configured for obtaining images of refrigerator appliance **100** during operation. Although camera assemblies **200** are described herein as being used to monitor fresh food chamber **122** of refrigerator appliance **100**, it should be appreciated that aspects of the present subject matter may be used to monitor any other suitable regions of any other suitable appliance, e.g., such as freezer chamber **124**. According to exemplary embodiments, camera assemblies **200** may be used to facilitate an inventory management process for refrigerator appliance **100**. As such, each camera assembly **200** may be positioned in view of fresh food chamber **122** or around fresh food chamber **122** to monitor food items (identified generally as objects **182**) that are being added to or removed from fresh food chamber **122**.

(33) It should be appreciated that the images obtained by camera assemblies **200** may vary in number, frequency, angle, resolution, detail, etc. in order to improve the clarity of the particular regions surrounding or within refrigerator appliance **100**. In addition, according to exemplary embodiments, controller **156** may be configured for illuminating the chilled chamber using one or more light sources prior to obtaining images. Notably, controller **156** of refrigerator appliance **100** (or any other suitable dedicated controller) may be communicatively coupled to camera assembly **200** and may be programmed or configured for analyzing the images obtained by camera assembly **200**, e.g., in order to identify items being added or removed from refrigerator appliance **100**.

(34) In general, controller **136** may be operably coupled to camera assemblies **200** for analyzing one or more images obtained by camera assembly **200** to extract useful information regarding objects **182** located within fresh food chamber **122**. In this regard, for example, images obtained by camera assembly **200** may be used to extract a barcode, identify a product, monitor the motion of the product, or obtain other product information related to object **182**. Notably, this analysis may be performed locally (e.g., on controller **156**) or may be transmitted to a remote server (e.g., remote server **176** via external communication network **170**) for analysis. Such analysis is intended to facilitate inventory management, e.g., by identifying a food item being added to or removed from the chilled chamber.

(35) Although a plurality of camera assemblies **200** are illustrated in FIG. **2** as being mounted to sidewalls **202** of a refrigerator liner **204**, it should be appreciated that refrigerator appliance **100** may include any other suitable number, type, position, and configuration of camera assemblies **200**. For example, one or more camera assemblies **200** may be mounted on top wall **206** of liner **204**. Indeed, camera assemblies **200** may be positioned in and around any chilled chamber and may each have a specified monitoring zone or range positioned around fresh food chamber **122**. A camera assembly **200** will now be described according to a non-limiting example embodiment of the present subject matter.

(36) Referring now generally to FIGS. **3** through **7**, a camera assembly **200** will be described according to an example embodiment of the present subject matter. As shown, camera assembly **200** may generally include a camera housing **210** that is mounted to sidewalls **202** of a chilled chamber (e.g., such as fresh food chamber **122**). For example, camera housing **210** may be positioned within an aperture **212** defined in liner **204** and may include a flange seated against an inner surface **214** of liner **204**. In this regard, camera assembly **200** may be at least partially positioned between liner **204** and cabinet **102**. According to example embodiments, camera assemblies **200** may further be foamed in place within liner **204**.

(37) As best shown in FIGS. **4** through **7**, camera assembly **200** may include a camera **220** that is

mounted within camera housing **210** and is pivotable between a first orientation and a second orientation. In this regard, according to the illustrated embodiment, camera assembly **200** may further include a pivoting mechanism **222** that is operably coupled with camera **220** and is configured for moving camera **220** between desired orientations in response to the position of the door **128**. Although an example pivoting mechanism **222** is described below as moving camera **220** between the first orientation and the second orientation, it should be appreciated that any suitable mechanism capable of rotating camera **220** between any suitable orientations may be used while remaining within the scope of the present subject matter.

(38) For example, cameras **220** may be mounted on a rotatable shaft that extends along the direction V. Door **128** may be mechanically coupled to the shaft through the top and bottom door hinge. Accordingly, when a user opens and closes door **128**, the mechanical coupling between door and the vertical shaft may cause camera **220** to rotate between a first and second orientation. It should be appreciated that various other mechanisms and mechanical couplings may be used to actuate camera **220** based on the movement door **128**, examples of which are defined below. Such mechanisms are contemplated as being within the scope of the present subject matter.

(39) According to the illustrated example embodiment, pivoting mechanism **222** includes a pivot arm **224** that generally defines a pivot axis **226**. Camera **220** may be positioned on pivot arm **224** such that rotating pivot arm **224** moves the field-of-view of camera **220** between various orientations. In this regard, pivot arm **224** may move to direct the field-of-view of camera **220** in different orientations. In general, as used herein the term “field-of-view” is generally intended to refer to the actual field-of-view or range of vision of camera **220** while the term “directed” is intended to refer to the primary focal point of camera **220** (e.g., at a center of the field-of-view).

(40) In general, the field a few of camera **220** in the first orientation may be primarily directed outside of fresh food chamber **122** while the field-of-view of camera **220** in the second orientation may be primarily directed into fresh food chamber **122**. In this regard, when door **128** a refrigerator appliance **100** is opened, camera assembly **200** may pivot camera **220** toward the threshold or opening of fresh chamber **122** or even outward toward a user refrigerator appliance **100**.

(41) In this manner, camera **220** may obtain images of one or more objects **182** being inserted into fresh food chamber **122**. In addition, when door **128** is subsequently closed, camera assembly **200** may pivot camera **220** back to the second orientation such that the object **182** may be viewed within fresh food chamber **122** and more details regarding the object **182** may be obtained. Notably, this configuration may provide improved knowledge as to the objects **182** within fresh food chamber **122** without requiring any further manual intervention by a user of refrigerator appliance **100** and without additional cost and complexity of cameras, camera drive systems, etc.

(42) Referring still generally to FIGS. **4** through **7**, pivoting mechanism **222** may generally include a biasing element **330** that urges camera **220** toward the first orientation. In addition, pivoting mechanism **222** may include a trigger mechanism **232** that overcomes biasing element **230** to urge camera **220** toward the second orientation when door **128** is closed. According to the illustrated embodiment, biasing element **230** is a mechanical spring **234**. In this regard, pivot arm **224** may have a first end **240** that is offset relative to pivot axis **226** and a second end **242** positioned opposite first end **240** relative to pivot axis **226**. In this regard, a line drawn between first end **240** and second end **242** may be perpendicular to pivot axis **226** and camera **220** may be positioned somewhere between first end **240** and second end **242**.

(43) According to the illustrated embodiment, mechanical spring **234** is in compression between camera housing **210** and first end **240** of pivot arm **224**. In this manner, mechanical spring **234** always urges pivot arm **224** toward a first orientation where camera **220** has a field-of-view directed primarily away from fresh food chamber **122** (e.g., across the threshold fresh food chamber **122** or toward a user of refrigerator appliance **100**). Accordingly, when no force is exerted on second end **242** of pivot arm **224**, camera **220** is biased toward the first orientation.

(44) According to example embodiments, trigger mechanism **232** is mounted to the door **128** and is

configured for engaging pivot arm **224** when the door **128** is close. In this regard, trigger mechanism **232** may be generally configured for overcoming the force exerted by biasing element **230** such that pivot arm **224** is rotated toward the second orientation. According to the illustrated embodiment, trigger mechanism **232** includes a camera magnet **250** that is mounted at second end **242** of pivot arm **224**. In addition, trigger mechanism **232** includes a door magnet **252** that is mounted to door **128** for engaging (e.g., magnetically coupling) camera magnet **250** as door **128** is moved into the closed position. For example, door magnet **252** may be foamed in place within an inner door liner of door **128**.

(45) Notably, biasing element **230** and trigger mechanism **232** are two mechanical devices that are configured for interacting with pivot arm **224** in order to rotate pivot arm **224**. It should be appreciated that these devices may be swapped or interchanged with equivalent devices or urging pivot arm **224** into the desired orientations. For example, mechanical spring **234** may be in tension instead of compression, the magnets **250**, **252** may have opposite polarity, other mechanisms may be used, etc. The specific embodiments described herein are only exemplary and are not intended to limit the scope of the present subject matter in any manner.

(46) According to the illustrated embodiment, the pivot axis **226** may be oriented along the vertical direction V when camera assemblies **200** are mounted on sidewalls **202** and may be oriented along the horizontal direction (e.g., such as the lateral direction L) when camera assemblies **200** are mounted on top wall **206**. In addition, although pivoting mechanism **222** is described as moving camera **220** between the first orientation and a second orientation, it should be appreciated that pivoting mechanism **222** may be configured to move camera **220** between any suitable number of positions or orientations.

(47) According to the illustrated embodiment, a pivot angle may be defined between camera **220** in the first orientation and the second orientation. In this regard, the pivot angle may be defined between the focal line or direction of the field-of-view of camera **220** between the first orientation in the second orientation. According to example embodiments, the pivot angle may be between about 5° and 60°, between about 15° and 45°, or about 30°. Other suitable pivot angles are possible and within the scope of the present subject matter.

(48) Referring now briefly to FIGS. **8** and **9**, camera assemblies **200** may be mounted in top wall **206** as illustrated according to an example embodiment. It should be appreciated that the mechanisms used to pivot camera assembly **200** between the first orientation and the second orientation may be similar to that described above with respect to FIGS. **4** through **7**. Accordingly, such mechanisms will not be repeated here. However, it should be appreciated that due to the horizontal orientation of pivot axis **226**, the weight of pivot arm **224** or a counterweight may be used to facilitate motion between the two orientations. In this regard, a biasing element may be omitted when camera assembly **200** is mounted in such an orientation (or a counterweight may itself act as such a biasing element). In addition, it should be appreciated that the trigger mechanism for overcoming the biasing element may be mounted to a top side of door **128**. For example, trigger mechanism **232** may be located within an articulating mullion of the door **128**.

(49) As explained herein, aspects of the present subject matter are generally directed to a system that utilizes a camera or a set of cameras to view a threshold of a fridge when a door is open and pivot the camera(s) to view inside the fridge when the door is closed. The system may use a simple magnetic catch and mechanical pivot-axis, such that a magnet is embedded in a foamed door to interact with a motion arm of a camera mechanism. Therefore, a single feature camera used for inventory management can also provide images of items stored on shelves. In addition, the complexity of such an assembly is low, reliability is improved, and costs are reduced.

(50) This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in

the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

Claims

1. A refrigerator appliance comprising: a cabinet; a liner positioned within the cabinet, the liner having an inner liner surface that defines a chilled chamber; a door being rotatably hinged to the cabinet to provide selective access to the chilled chamber; and a camera assembly mounted to the liner for monitoring the chilled chamber, the camera assembly comprising: a camera housing; a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation; and a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position, wherein the pivoting mechanism comprises a biasing element that urges the camera toward the first orientation and a trigger mechanism that overcomes the biasing element to urge the camera toward the second orientation when the door is closed, wherein the trigger mechanism is located within an articulating mullion of the door.
2. The refrigerator appliance of claim 1, wherein the pivoting mechanism comprises: a biasing element that urges the camera toward the first orientation; and a trigger mechanism that overcomes the biasing element to urge the camera toward the second orientation when the door is closed.
3. The refrigerator appliance of claim 2, wherein the biasing element is a mechanical spring.
4. The refrigerator appliance of claim 2, wherein the camera assembly further comprises: a pivot arm defining a pivot axis, a first end offset relative to the pivot axis, and a second end positioned opposite the first end relative to the pivot axis, wherein the biasing element is in compression between the camera housing and the first end of the pivot arm.
5. The refrigerator appliance of claim 2, wherein the trigger mechanism comprises: a camera magnet mounted offset relative to a pivot axis of the camera; and a door magnet mounted to the door for engaging the camera magnet as the door is moved into the closed position.
6. The refrigerator appliance of claim 5, wherein the camera assembly further comprises: a pivot arm having a first end offset relative to the pivot axis, and a second end positioned opposite the first end relative to the pivot axis, wherein the camera magnet is mounted to the second end of the pivot arm.
7. The refrigerator appliance of claim 5, wherein the door magnet is embedded in foam within an inner door liner.
8. The refrigerator appliance of claim 5, wherein the pivoting mechanism comprises a linkage arm that extends from the door for engaging the camera.
9. The refrigerator appliance of claim 1, wherein the first orientation of the camera includes a field of view that is primarily directed outside the chilled chamber and the second orientation of the camera includes a field of view that is primarily directed into the chilled chamber.
10. The refrigerator appliance of claim 1, wherein a pivot angle is defined between the camera in the first orientation and the second orientation, the pivot angle being between about 15 and 45 degrees.
11. The refrigerator appliance of claim 10, wherein the pivot angle is about 30 degrees.
12. The refrigerator appliance of claim 1, wherein the liner defines an aperture that passes through the liner, and wherein at least a portion of the camera assembly is positioned between the liner and the cabinet adjacent the aperture.
13. The refrigerator appliance of claim 1, wherein the refrigerator appliance comprises a plurality of light assemblies mounted to sidewalls of the liner, the plurality of light assemblies being spaced apart along a vertical direction.

14. The refrigerator appliance of claim 1, wherein the camera assembly is mounted in a sidewall of the chilled chamber and a pivot axis of the camera extends along a vertical direction.
15. The refrigerator appliance of claim 1, wherein the camera assembly is mounted in a top wall of the chilled chamber and a pivot axis of the camera extends within a horizontal plane.
16. A camera assembly for a refrigerator appliance, the refrigerator appliance comprising a liner positioned within a cabinet, the liner having an inner liner surface that defines a chilled chamber, and a door being rotatably hinged to the cabinet to provide selective access to the chilled chamber, the camera assembly comprising: a camera housing; a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation; a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position, wherein the pivoting mechanism comprises a biasing element that urges the camera toward the first orientation and a trigger mechanism that overcomes the biasing element to urge the camera toward the second orientation when the door is closed; and a pivot arm defining a pivot axis, a first end offset relative to the pivot axis, and a second end positioned opposite the first end relative to the pivot axis, wherein the biasing element is in compression between the camera housing and the first end of the pivot.
17. An appliance comprising: a cabinet defining a chamber; a door rotatably hinged to the cabinet to provide selective access to the chamber; and a camera assembly mounted to the cabinet for monitoring the chamber, the camera assembly comprising: a camera housing; a camera mounted within the camera housing and being pivotable between a first orientation and a second orientation; and a pivoting mechanism that is operably coupled to the door such that the camera is oriented in the first orientation when the door is in an open position and in the second orientation when the door is in a closed position, wherein the pivoting mechanism comprises a biasing element that urges the camera toward the first orientation and a trigger mechanism that overcomes the biasing element to urge the camera toward the second orientation when the door is closed; and a pivot arm defining a pivot axis, a first end offset relative to the pivot axis, and a second end positioned opposite the first end relative to the pivot axis, wherein the biasing element is in compression between the camera housing and the first end of the pivot arm.