



(11)

**EP 4 249 835 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**27.09.2023 Bulletin 2023/39**

(51) International Patent Classification (IPC):  
**F25D 23/08** <sup>(2006.01)</sup> **A47F 3/04** <sup>(2006.01)</sup>  
**F25D 23/02** <sup>(2006.01)</sup>

(21) Application number: **22163593.1**

(52) Cooperative Patent Classification (CPC):  
**F25D 23/087; A47F 3/043; F25D 23/028**

(22) Date of filing: **22.03.2022**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**KH MA MD TN**

(71) Applicant: **Carrier Corporation**  
**Palm Beach Gardens, FL 33418 (US)**

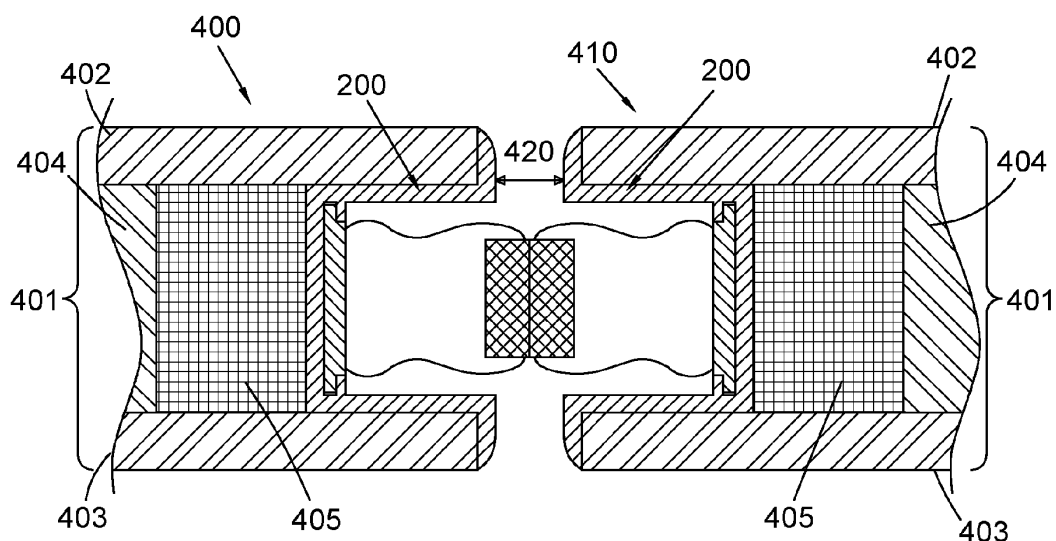
(72) Inventor: **BIRKE, Sven-Oliver**  
**65187 Wiesbaden (DE)**

(74) Representative: **Dehns**  
**St. Bride's House**  
**10 Salisbury Square**  
**London EC4Y 8JD (GB)**

(54) **GASKET SYSTEM FOR A REFRIGERATOR**

(57) A gasket system 200 for providing a reversible seal between a first surface and a second surface of a refrigerator unit is disclosed. The first surface is moveable relative to the second surface. The gasket system comprises: a bellow 230 comprising an inner end and a distal end; a magnet 240 disposed on the distal end of the bellow; and a bracket 250 for attaching the bellow to the first surface or the second surface. The bracket 250 comprises an open ended cavity 251; and the inner end of the bellow 230 is arranged to be connected to the inner

surface of the cavity of the bracket 250 opposite the open end of the cavity. When the bellow 230 is connected to the bracket 250, the bellow is movable between a stowed position and a sealing position. In the stowed position the bellow 230 is retracted so as to be disposed completely within the cavity 251 of the bracket 250, and in the sealing position the bellow extends from the cavity 251. The bellow 230 is resiliently biased towards the stowed position.



**FIG. 4**

**EP 4 249 835 A1**

## Description

**[0001]** The present invention relates to a gasket system, a sealing system, a refrigerator unit and a method of providing a reversible seal between a first surface and a second surface, wherein the first surface is moveable relative to the second surface.

**[0002]** A gasket system is used to provide a seal between two surfaces such that when those surfaces are moved apart from each other the seal is broken, and when the surfaces are moved towards each other the seal is reformed. Such a gasket system is useful for providing a seal between the doors and frame of a refrigerator unit.

**[0003]** Seals that are provided on doors of refrigeration units in the prior art are typically flexible sealing systems such as lips, tubes or brushes which can deform as the gap to be sealed changes as the door opens. However, these seals have a limited ability to adapt to the length of the gap between the door and the corresponding sealing surface when in the closed position. They therefore have a low tolerance to any changes in the gap that may occur following each opening or closing of the door, or which may develop over time. Similarly, to the variation in the length of the gap between the door and sealing surface over time, the alignment of the door and sealing surface can vary over time. In these cases, the seals of the prior art may have a low effectiveness at maintaining a proper seal, and the reliability of the system may be reduced as a result.

**[0004]** Refrigeration cabinets are known to employ doors hung on hinges and openable via rotation. In such systems, seals supplied by sealing systems of the prior art may not provide the necessary space for the doors to move past the sealing surface as it rotates to open. In particular, the seals that rely on a flexible material to close the gap will endure obstruction of the opening movement. This can lead to excess wear which can reduce the effectiveness of the seal further, and damage which can reduce the lifetime of the components.

**[0005]** Such gasket systems known in the art are applied to dual doors present on refrigerators.

**[0006]** There is therefore a desire to provide a gasket system which overcomes these drawbacks.

**[0007]** Viewed from a first aspect, there is provided a gasket system for providing a reversible seal between a first surface and a second surface of a refrigerator unit, wherein the first surface and/or the second surface are moveable relative to the other surface, the gasket system comprising: a bellow comprising an inner portion and a distal portion; a magnet disposed at the distal portion of the bellow; and a bracket for attaching the bellow to the first surface or the second surface, wherein the bracket comprises an open ended cavity; wherein the inner portion of the bellow is arranged to be connected to the inner surface of the cavity of the bracket opposite the open end of the cavity; wherein, when the bellow is connected to the bracket, the bellow is movable between a stowed

position and a sealing position; wherein, in the stowed position the bellow is retracted so as to be disposed completely within the cavity of the bracket, and in the sealing position the bellow extends from the cavity; and wherein the bellow is resiliently biased towards the stowed position.

**[0008]** The gasket system may be used for any installation that requires a reversible seal. The gasket system may be particularly suited to installations that require a seal to inhibit or significantly reduce the flow of air through a gap. In this way the gasket system may be effective at providing an insulating effect. The seal afforded by the gasket may be reversible in that the seal can be formed and broken, and subsequently reformed. This forming and breaking of the seal may be performed many times. This may be particularly of use when the surfaces, between which there is a gap which is required to be sealed, are also required to be separated. For example, due to the opening and closing of doors.

**[0009]** The bellow may comprise or be an extendible and retractable piece of material. The bellow may have folding, e.g. concertinaed, sides to allow the bellow to expand to the sealing position and retract to the stowed position. The bellow may be a single piece of material. Alternatively, the bellow may be formed from multiple pieces of material such as two. For example, one piece may extend from the bracket to one side of the magnet and the another piece may extend from the other side of the magnet to the bracket thereby together forming the bellows.

**[0010]** The bellow may be made of a material that blocks the flow of air. The bellow may be able to block the flow of air between the first and second surfaces by forming a barrier within a gap between the first surface and the second surface. Thus, the bellow may be used to seal the gap between the first and second surfaces.

**[0011]** The bellow may comprise an inner portion, a distal portion, and two sides extending therebetween. The sides may be a forward side and an aft side. The inner portion may be at, or towards the inner end of the bellow. This inner portion may be attached to the bracket. The inner portion may comprise a fixing piece.

**[0012]** The distal portion may be at or towards the distal end of the bellow. This distal end may be remote from the end that attaches to the bracket.

**[0013]** The forward side may provide a first side between the inner end and distal end. The aft side may provide a second side (which may be opposite the first side) between the inner end and the distal end of the bellow. The bellow (optionally in combination with the magnet) may create a loop in cross-section.

**[0014]** When the gasket system is used on a refrigerator unit, it may be positioned so that the forward side faces the outside of the refrigerator unit and the aft side faces the inside of the refrigerator unit.

**[0015]** The magnet is disposed at the distal portion of the bellow. The magnet may be positioned to face the direction of the second surface when the first and second

surfaces are in a position to be sealed, i.e. a closed position.

**[0016]** The bellow may consist of a first piece being the forward side and a second piece being the aft side. In this case, the magnet may connect the forward side of the bellow to the aft side of the bellow at the distal end. Alternatively, the bellow may consist of one piece which forms the forward side, the distal region and the aft side. In this case, the magnet may be disposed on and/or in the bellow at the distal portion.

**[0017]** When the gasket system is assembled, the bellow is attached to the bracket, and the bracket is arranged to be attached to the first surface. The bracket comprises an opened ended cavity. The bracket may be formed in the shape of an opened ended cavity, i.e. a 'U' shape, and the bellow may be disposed in the cavity. The opened ended cavity may comprise an open end, an inner surface opposite the open end and first and second side surfaces extending either side between the inner surface and the open end.

**[0018]** In use, the open end of the cavity may face away from the first surface on or in which the bracket is disposed. Thus, in use, the open end of the cavity may face towards the second surface when the first and second surfaces are in a position to be sealed, i.e. a closed position.

**[0019]** In the sealing position, part of the bellow (and hence magnet) may extend from (i.e. protrude from) the open end of the cavity. The bellow may extend towards and/or connect to the second surface when the first and second surfaces are in a position to be sealed.

**[0020]** The bellow may be fixed at one end in the cavity of the bracket by connection between the inner portion of the bellow and the inner surface of the cavity. Thus, even when in the sealing position, a portion of the bellow (including the distal portion) may still be housed within the cavity of the bracket.

**[0021]** The gasket system, e.g. bracket, bellow and magnet, may be attached to the first surface. The second surface may be a magnetically attractive surface.

**[0022]** The first surface may be movable relative to the second surface, the second surface may be movable relative to the first surface and/or both the first surface and the second surface may be movable surfaces.

**[0023]** The bellow is movable between a stowed position and a sealing position.

**[0024]** In the stowed position the bellow and the magnet may be disposed within the bounds of the cavity and not extend beyond the open end of the cavity.

**[0025]** Disposed completely within the cavity encompasses the distal end of the bellow and/or magnet being just within the cavity. In this case, the outward facing surface of the magnet and/or bellow may be in line with the outermost surface of the bracket. In other words, in the stowed position, the front surface of the magnet may be at the same level as the front surface of the bracket or behind the front surface of the bracket within the cavity.

**[0026]** When the bellow is in the stowed position, the

magnet may still be located close enough to the front surface of the bracket so that when it is in close proximity and/or adjacent to a magnetically attractive surface the bellow is moved into the sealing position.

5 **[0027]** In the sealing position the distal portion of the bellow and the magnet may extend from the cavity. In the sealing position the magnet may be located entirely outside of the cavity and/or beyond the front surface of the bracket.

10 **[0028]** When the magnet is not attracted to a surface, the bellow may be in the stowed position as a result of the bias acting upon the bellow. Therefore, when a seal is not formed using the gasket, the bellow and magnet may be fully contained within the cavity.

15 **[0029]** Due to the resilient bias acting on the bellow, the bellow may naturally be retracted to the stowed position. When the magnet is attracted to a magnetically attractive surface outside of the bracket (e.g. the second surface), the magnetic force may overcome the resilient bias acting on the bellow and thereby move the bellow into the sealing position.

20 **[0030]** The resilient bias acting on the bellow may be provided by the shape and/or material of the bellow. The natural position of the bellow may be in a contracted position.

25 **[0031]** When the first and second surfaces are moved apart, this may move the magnet away from the magnetically attractive surface. This may allow for the gap between the first and second surfaces to be re-established. This gap may be beneficial for allowing smooth operation of the movement mechanism between the first and second surfaces. The retraction of the bellow may also afford protection from damage to the bellow and magnet. Since the bellow extends to a length and position sufficient to meet the second surface, the gap between the first and second surface is sealed securely and is adaptable to changes which may occur in the orientation or size of the gap between the surfaces whilst maintaining the tight seal.

30 **[0032]** The bellow may be longitudinally extending and the magnet may extend along the length of the bellow. The magnet may extend along the entire length of the bellow.

35 **[0033]** The gasket system may have a width which is the dimension in the direction from one side surface of the bracket to the other side surface. The gasket system may have a depth which is the dimension in the direction from the open end of the cavity of the bracket to the inner surface of the cavity opposite the open end. The gasket system may have a length which is the dimension perpendicular to the width and depth of the gasket system. The length may be the dimension in the direction from one end of the gasket system to the other end of the gasket system. The length of the gasket system may be significantly larger than the width and/or depth of the gasket system. For example, the length of the gasket system may be at least 10 times larger than the width and/or depth of the gasket system.

**[0034]** The longitudinally extending bellow may be suitable for extending along a length of a first surface such as a door, frame or wall. The gasket system may be suitable for sealing the entire length of a gap which may be present between the first surface, such as the door, frame or wall and the second surface, which may be a door, frame or wall. In the case of the magnet extending along the entire length of the bellow, the seal may be tightly maintained along the entire length of the bellow by the joining of the magnet to the second surface.

**[0035]** When attached to the first surface, the gasket system may be vertically extending. In this case the length of the gasket system may extend in a vertical direction. The gasket system may be used to seal a vertical gap between two surfaces. This may for example be a vertically extending gap between the end faces of a pair of doors.

**[0036]** The first surface may be an end surface of a door and/or the second surface may be the end face of a door. The end face may be the surface between the front and back surfaces of the door and/or may be the surface distal from the hinge of the door. The gasket system may extend along the length of the end face of the door.

**[0037]** The magnet may be comprised of a single strip magnet that extends along the length of the bellow, or may be comprised of a plurality of individual magnets arranged on the bellow so as to be continually extending along the length of the bellow.

**[0038]** Alternatively, the bellow may be longitudinally extending and the magnet may be formed of individual magnets present at intervals along the length of the bellow. In this case, the gasket may comprise multiple magnets arranged along the length of the bellow, and the magnets may be arranged so that there are gaps in the longitudinal direction of the bellow between one or more neighbouring magnets. With this arrangement a smaller mass of magnetic material is required and the gasket may be cheaper and its production may consume less resources.

**[0039]** The bracket and/or bellow may be transparent. Thus the bracket and/or bellow may comprise or be formed of a transparent material.

**[0040]** This means that light may be able to pass through the bracket and/or bellow, so that objects behind the gasket system do not become substantially obscured from view.

**[0041]** The gasket system, bracket, bellow and/or any fixing means such as adhesive may be clear-sighted. When the gasket system is installed it may not obscure the view of the user to the inside of the refrigeration unit.

**[0042]** It may be undesirable to prohibit the ability to see objects behind the gasket. For example, if the system is used as a display cabinet, and it may reduce the efficiency of the system to which the gasket is attached if the seal, employed for insulation purposes, is broken in order to see objects behind the gasket.

**[0043]** The bracket and/or bellow may be composed

of a plastic. The plastic may be polyvinyl chloride (PVC). The bracket may comprise or be formed of a rigid plastic (e.g. PVC). Thus the bracket may provide a stiff casing for the bellow and/or may provide a robust means of attachment between the gasket and the surface to which it is applied. The bellow may comprise or be formed (at least partly) of a flexible plastic (e.g. PVC). The bellows comprising a flexible material may allow it to deform when moving between the stowed position and the sealing position. Thus the sides of the bellows may be made of a flexible material. The bellow may also comprise a rigid part. In particular, the fixing piece which allows the bellow to be attached to the bracket may be formed of a rigid material. The fixing piece, the sides of the bellow and/or the magnet may be coextruded. The bellow comprising the sides and the fixing piece, and the magnet may be formed as a single integrally formed component. Alternatively, the bellow and magnet may be separately formed and then connected together. Similarly, the sides and fixing piece of the bellow may be separately formed and then connected together.

**[0044]** The gasket system may be referred to as a soft pleat magnetic gasket. This may be due to the presence of the soft flexible material of the sides of the bellows, the pleated shape of the sides of the bellows and the use of the magnet in the sealing arrangement.

**[0045]** It may be beneficial to use plastics to form the gasket system as plastics are a convenient and cheap material with adequate strength as may be required by the gasket system.

**[0046]** The bellow may be comprised of an elastically deformable material. The elastically deformable material may provide the resilient bias. When not subjected to any external forces, the bellow may be in the retracted stowed position. The bellow may be elastically deformed as it extends to the sealing position under the action of a force, such as a magnetic force acting in a direction to extend the bellow out of the cavity. When that force no longer acts upon the bellow, the bellow may return to the stowed position as a result of the resilient biasing.

**[0047]** By providing the biasing means integrally to the bellow (e.g. by means of its material and shape), the complexity of the system may be reduced compared to biasing the bellow through an additional means.

**[0048]** The bellow may comprise corrugations. The corrugations may form zig-zag shapes in cross section. The corrugations may provide the bellow with a concertina configuration. The corrugations may be formed by folds in the material of the bellow. The bellow may comprise pleats that allow extension from the stowed position to the sealing position.

**[0049]** The corrugations/pleats may provide the bellow with preferential folds along which the bellow can deform in order to extend to the sealing position and retract to the stowed position. The use of the corrugations/pleats may assist in achieving a uniform extension of the bellow from the inner portion to the distal portion. This may allow a controlled extension and retraction movement and may

assist in guiding the bellow correctly to each of the stowed and sealing positions. In turn, this may reduce the chance of damage to the bellow.

**[0050]** The bellow may comprise a fixing piece at the inner end. The bracket may comprise a slot on the inner surface of the cavity opposite the open end of the cavity. The bellow may be fixed to the bracket by the fixing piece being inserted (e.g. slid, press fit and/or snap fit) into the slot. The slot of the bracket may be shaped to provide a stop so that the bellow is not detached from the bracket by movement of the bellow perpendicular to the inner surface of the cavity of the bracket opposite the open end of the cavity. The cavity of the bracket may have protrusions on the side surfaces that form the slot into which the fixing piece may be inserted. For example, the slot and fixing piece may comprise a dove tail arrangement.

**[0051]** The fixing piece may be inserted (e.g. slid) into the slot in a longitudinal direction of the gasket system. The fixing piece may be inserted (e.g. press fit and/or snapped) into the slot in a direction perpendicular to the longitudinal direction of the gasket system. This may for example be by the fixing piece being forced into the slot by being pushed in a depth direction of the cavity.

**[0052]** Using the fixing piece and slot configuration, the bellow may be reversibly affixed to the bracket in a simple and convenient manner.

**[0053]** Viewed from a second aspect, there is provided a sealing system for a refrigerator unit. The sealing system comprises: a first surface; a second surface provided with a magnetically attractive surface, wherein the first and/or second surfaces are movable relative to one another to a closed position in which the first and second surfaces are at their closest approach; and a first gasket system attached to the first surface for providing a reversible seal between the first surface and the second surface when the first and second surfaces are in the closed position.

**[0054]** The gasket system may be the gasket system as described above in relation to the first aspect. The gasket system may have one, or more, or all of the above described features, including optional features.

**[0055]** The gasket system attached to the first surface may seal a gap between the first surface and the second surface when surfaces are in the closed position and the bellow is in the sealing position.

**[0056]** The first surface may be arranged so as to be movable and the second surface arranged to be stationary, or the second surface may be arranged so as to be moveable and the first surface arranged to be stationary, or both the first and second surfaces may be arranged so as to be moveable.

**[0057]** The magnetically attractive surface is provided on the second surface. In the closed position, the magnet of the gasket provided on the first surface may be attracted to the second surface causing the bellow to extend to the sealing position. With the bellow in the sealing position, the magnet of the gasket may contact the magnetically attractive surface of the second surface.

**[0058]** The bellow may be extended into the sealing position through action of the magnetic attractive force between the magnet at the distal portion of the bellow and the magnetically attractive surface. When the resilient bias of the bellow is provided by a resilient elastic material of the bellow, the bellow may be elastically extended through action of the magnetic attractive force between the magnet at the distal portion of the bellow and the magnetically attractive surface.

**[0059]** As the first surface, and hence the gasket, is brought into proximity with the magnetically attractive surface, the attractive force between the magnet and the surface may become sufficient to overcome the biasing force of the bellow. The bellow may hence extend until the magnet and the magnetically attractive surface are in contact. Hence, when the bellow is in the sealing position the bellow may be elastically strained. When the first surface, and hence the gasket, is moved (e.g. pulled) away from the magnetically attractive surface, the attractive force between the magnet and the surface may no longer be sufficient to overcome the biasing force, and thus the bellow may retract to the stowed position.

**[0060]** The magnetically attractive surface of the second surface may be provided by a second gasket system.

**[0061]** The second gasket system may be the gasket system as described above in relation to the first aspect. The second gasket system may have one, or more, or all of the above described features including optional features. The first gasket system and second gasket system may have the same features or they may be different. The first gasket system and the second gasket system may be identical.

**[0062]** Two gasket systems may be used together in a sealing system to seal wider gaps between the relevant surfaces.

**[0063]** The first surface may be a movable surface such as the surface of a first door. The door may be a door of a refrigerator unit. The second surface may either be a surface of a second movable part such as a door or a stationary surface such as a surface of a wall or frame. The gasket system may hence be applied to a door. The door on which the gasket system is mounted may be opened and closed relative to the second surface. When the door is closed the bellow may extend to the sealing position to seal a gap between the door and the second surface. As the door is opened the magnet of the gasket system may separate from the second surface and the bellow may retract to the stowed position.

**[0064]** When the gasket system is mounted on the door, it may extend vertically on the end face of the door.

**[0065]** The first surface may be a stationary surface such as a wall or frame and the second surface may be a movable surface such as a surface of a door. The gasket may hence be applied to a stationary surface and form a seal with a surface of a door when that door is closed.

**[0066]** The first surface may be moveable relative to the second surface via rotation of the first and/or second

surface, e.g. door, about a hinge. The door, or doors, of the sealing system may hence be mounted on a hinge. Where the first and second surfaces are both provided on doors, e.g. end faces of the doors, and both doors are mounted on hinges the system may form a French door, or swing door, system. In other words, the doors may be a pair of French doors. The gasket system(s) may seal the gap between the end faces of the doors. Due to the rotation about the hinge, as the door opens it moves past the corresponding surface parallel to the plane of the end surface, it therefore may be beneficial for the bellow and magnet to retract into the cavity of the bracket so as to avoid damage to the opposite surface, as well as preventing damage to the bellow and magnet of the gasket. When the door is in an open position the retraction of the bellows and magnet into the cavity may help protect the gasket system from being damaged.

**[0067]** The gasket system may be set into, e.g. recessed into, the door to allow the retraction of the bellow when in the stowed position to be within the door.

**[0068]** The open end of the cavity of the bracket may be provided at the end face of the door (with the other parts of the bracket recessed within the door). This means that the gasket system may be housed and/or hidden within the door. This means that the gasket system may be protected by the structure of the door itself. When the bellow is in the stowed position the bellow and magnet may be disposed completely within the door. When the bellow is in the sealing position the magnet and/or part of the bellow may extend beyond the end face of the door.

**[0069]** The bracket may be located between the two panes of a double glazed door.

**[0070]** The first and/or second gasket system, e.g. the bracket, may be arranged to provide a seal for an air gap between two panes of a double-glazed door. This may mean that the gasket system can be used to contribute to the insulating effect of the double glazed door by sealing air between the panes of glass.

**[0071]** The first and/or second gasket system, e.g. the bracket, may be arranged to act as a spacer between two panes of a double-glazed door. This may mean that the gasket system can be used to contribute to the structure of the double glazed door by providing a fixed distance between the two panes of glass.

**[0072]** The double-glazed door may additionally comprise a spacer between the two panes of glass. This spacer may be located rearward of the bracket between the two panes of glass. This spacer may be any known double glazing spacer and/or glass edge seal. For example, the spacer may comprise a spacer pipe with desiccant therein that is sealed to the glass with a sealant such as butyl.

**[0073]** The spacer, if present, may be a transparent and/or clear-sighted component, such as a block formed of PMMA, that is fixed and sealed to the two panes of glass by adhesive such as adhesive tape or glue.

**[0074]** The gasket system, i.e. bracket, may be set into

the double glazed door to also allow the retraction of the bellow when and magnet in the stowed position to be within the double glazed pane. The gasket system, e.g. bracket, may be glued between the two panes of the double glazed door.

**[0075]** Viewed from a third aspect, there is provided a refrigerator unit comprising one or more sealing system(s) according to the second aspect.

**[0076]** Each sealing system may comprise one or more or all of the features of the sealing system of the second aspect.

**[0077]** A refrigerator unit may benefit in particular from the gasket system to seal the refrigerated air in the unit. The connection of the magnet of the gasket system to the magnetically attractive second surface may hence be advantageous to ensure the seal is repeatedly reproduced each time the door(s) are opened and closed. The improved compensation of gap tolerances may hence contribute to the energy efficiency of the refrigerator cabinet.

**[0078]** The refrigerator unit may be a refrigerator cabinet. The refrigerator cabinet may comprise a pair of French doors. The gasket system of the first aspect (including one or more or all of the optional features of the gasket system) may be provided on one or both of the doors. The gasket system(s) may be provided on (e.g. recessed into), the end face of each door. The gasket system(s) may be located between two panes of a double glazed door at an end face of the door. The gasket system(s) may extend vertically along the length of the end face of the door on which it is mounted.

**[0079]** The refrigerator unit may be a multideck refrigerator display cabinet. Such a refrigerator cabinet may have multiple shelves and/or a large volume of refrigerated space. Such a display cabinet may be frequently opened and closed. The retraction of the bellow to clear a gap between the door(s) of the cabinet may therefore be advantageous to avoid damage in such a cabinet and in particular reduce chance of damage to the gasket system itself. The avoidance of contact between the doors and the gasket may ensure that there is minimal resistance during opening and closing. The gasket system may therefore contribute to improved durability of the sealing system and the refrigerator cabinet, as well as improved door handling and comfort.

**[0080]** Viewed from a fourth aspect, there is provided a method of providing a reversible seal between a first surface and a second surface of a refrigerator unit, wherein the first surface and/or second surface is moveable relative to the other surface. The method comprises: providing a gasket system on the first surface, the gasket system comprising a bellow comprising an inner portion and a distal portion; a magnet disposed at the distal portion of the bellow; and a bracket comprising an open ended cavity, wherein the bellow is attached at its distal portion to the bracket; wherein the gasket system is attached to the first surface via the bracket, wherein the bellow is

for extending across a gap between the first and second surfaces when the first and second surfaces are in a closed position; resiliently biasing the bellow to a stowed position in which the bellow is retracted and disposed completely within the cavity of the bracket; moving the first and second surfaces to a closed position at which they are at their closest approach such that the magnet engages with the second surface, and as a result, the bellow extends from the cavity into a sealing position; and moving the first and/or second surface away from the closed position such that the magnet disengages with the second surface and, as a result of the biasing, the bellow returns to the stowed position.

**[0081]** The gasket system may be the gasket system of the first aspect. The gasket system may comprise one or more or all of the above described features of the gasket system.

**[0082]** The method may comprise providing a second gasket system on the second surface. The second gasket system may also be the gasket system of the first aspect. The second gasket system may comprise one or more or all of the above described features of the gasket system.

**[0083]** The method of the fourth aspect may be performed using one or more sealing system(s) of the second aspect. The sealing system(s) may comprise one or more or all of the above described features of the sealing system.

**[0084]** The method of the fourth aspect may be performed using a refrigerator unit of the third aspect. The refrigerator unit may comprise one or more or all of the above described features of the refrigerator unit.

**[0085]** Thus any feature of any aspect may be applied to one or more or all of the other aspects of the invention. Thus, all of the above described features may be applicable to any of the aspects of the invention.

**[0086]** Certain preferred embodiments of the present invention will now be described, by way of example only, with reference to the following drawings in which:

Figure 1 shows a cross sectional plan view of two doors;

Figure 2 shows a cross sectional plan view of a gasket in a stowed position;

Figure 3 shows a cross sectional plan view of a gasket in a sealing position;

Figure 4 shows a cross sectional plan view of two doors each having a gasket system installed therein;

Figure 5 shows a cross sectional plan view of a bracket of a gasket system installed within a door;

Figure 6 shows a cross sectional plan view of a bellow of a gasket system;

Figure 7 shows a cross sectional plan view of a bellow of a gasket system;

Figure 8 shows a cross sectional plan view of two doors moving towards a closed position;

Figure 9 shows a cross sectional plan view of the two doors in the closed position; and

Figure 10 shows a refrigeration unit.

**[0087]** Figure 1 shows a first door 100 and a second door 110. The doors 100, 110 are movable with respect to one another. With the doors 100, 110 positioned at the closest approach to one another, i.e. when the doors 100, 110 are closed, there is a gap 120 between the first door 100 and the second door 110. In this example, the doors 100, 110 are each hinged so that they may move relative to one another via rotation.

**[0088]** The gap 120 is required to provide sufficient space for the doors 100, 110 to move past each other as either one, or both, of the doors 100, 110 is rotated about its respective hinge.

**[0089]** Each of the doors 100, 110 comprise a double glazed panel 101 having a first pane of glass 102, a second pane of glass 103 and an insulating layer 104 there between. The insulating layer 104 may be a sealed gap filled with air or air with argon and/or xenon. Each door also comprises an end piece 105 which provides a seal between the first pane of glass 102, second pane of glass 103 and the insulating layer 104. The end piece 105 may be any known means to give a fixed distance between the two panes of glass and to seal the insulating layer 104. The end piece 105 may be provided by a single component or multiple components to achieve the function of a spacer and a seal between the panes of glass.

**[0090]** As a result of the gap 120, even with the doors in the closed position air is able to flow from the area behind the door to the area in front of the doors and vice versa.

**[0091]** Figure 2 shows a gasket system 200 in cross section. The gasket system 200 extends longitudinally in a direction perpendicular to the cross section shown in Figure 2, i.e. perpendicular to the plane of the paper. The gasket system 200 comprises a bracket 250 and a bellow 230 attached thereto. The gasket system 200 further comprises a magnet 240.

**[0092]** The bellow 230 comprises an inner end and a distal end, the distal end being distal relative to the attachment of the bellow 230 to the bracket 250. The bellow 230 comprises a forward side 235 which extends from the inner end to the distal end and is on a first side that faces a first direction, and an aft side 236 which extends from the inner end to the distal end and is on a second side that faces a second direction opposite to the first direction. The magnet 240 is present at the distal end of the bellow 230. The bellow 230 comprises a first flexible piece forming the forward side 235 and a second flexible piece forming the aft side 236. In this case, the magnet 240 connects the forward side 235 of the bellow 230 to the aft side 236 of the bellow 230 at or towards the distal end. In other examples, the bellow 230 may comprise or consist of one piece which forms the forward side 235 and the aft side 236. In this case, the magnet 240 may be disposed on the bellow 230 at or towards the distal end.

**[0093]** The bellow 230 is attached to the bracket 250

at its inner end. The bracket 250 is formed in a shape to form an opened ended cavity 251, i.e. the bracket 250 comprises or consists of a 'U' shape, and when the bellow is attached to the bracket 250, the bellow 230 is disposed in the cavity 251.

**[0094]** The bellow 230 is biased towards a stowed position as shown in Figure 2. In the stowed position, the bellow 230 and the magnet 240 are completely contained within the cavity 251 of the bracket 250. In figure 2, the front surface of the magnet 240 is shown a small distance within the cavity 251. However, in the stowed position the front surface of the magnet 240 may also be in line with the front surface of the bracket 250 as shown for example in figure 8.

**[0095]** The bellow 230 may be composed of an elastically deformable material, such that the elastically deformable material provides the resilient bias towards the stowed position.

**[0096]** The bellow 230 is retained in the cavity 251 of the bracket 250 by connection between the inner end of the bellow 230 and an inner surface 252 of the cavity 251 opposite the open end 253 of the cavity. In the system shown, the connection is formed between a fixing piece 237 of the bellow 230 and a slot 254 formed in the inner surface 252 of the cavity 251. In this example, the bellow 230, and magnet 240 may be attached to the bracket 250 by sliding the fixing piece 237 of the bellow 230 into the slot 254 in a longitudinal direction. Alternatively, the fixing piece 237 may be forced into the slot 254 by pushing the fixing piece 237 into the cavity 251 in a depth direction from the open surface of the cavity 251 to the back surface of the cavity where the slot 254 is located.

**[0097]** The fixing piece 237 may be formed of a hard and/or rigid material such as hard plastic. The sides of the bellow 230 may be formed of a soft material. Thus the fixing piece 237 may be formed of a material that is hard and/or rigid relative to the material of the sides of the bellow 230.

**[0098]** The bellow 230 (including the flexible sides and the fixing piece) and the magnet 240 may be integrally formed. The fixing piece 237 and the bellow 230 may be coextruded.

**[0099]** As shown in Figure 3, the bellow 230 is extendible to a sealing position. In this configuration the bellow 230 and the magnet 240 protrude from the cavity 251 of the bracket 250. In this position the magnet 240 is therefore able to contact a surface to form a seal therewith. The bellow 230 is movable between the stowed position and the sealing position through the action of an attractive magnetic force between the magnet 240 and the surface with which the seal is formed. Thus, the surface with which the seal is formed may be a magnetically attractive surface. This may be a magnetic metal surface or it may be a second gasket system as shown in figure 4 for example.

**[0100]** Figure 4 shows an arrangement with a first door 400 and a second door 410. The doors 400, 410 are movable with respect to one another. With the doors 400,

410 positioned at the closest approach to one another, i.e. when the doors 400, 410 are closed, there is a gap 420 between the first door 400 and the second door 410. In this example, the doors 400, 410 are each hinged so that they may move relative to one another via rotation. Such an arrangement may be referred to as French doors.

**[0101]** The gap 420 provides sufficient space for the doors 400, 410 to move past each other as either one, or both, of the doors 400, 410 is rotated about its hinge. Each of the doors 400, 410 comprise a double glazed panel 401 having a first pane of glass 402, a second pane of glass 403 and an insulating layer 404. The insulating layer 404 may be a sealed gap containing air or air with a noble gas for example.

**[0102]** Between the panes of glass of each door there is a spacer 405. The spacer 405 acts to hold a fixed distance between the panes of glass 402, 403 and to seal the insulating layer 404. However, this spacer 405 could be omitted and instead the bracket 250 may act as the means to hold a fixed distance between the panes of glass 402, 403 and/or to seal the insulating layer 404. The bracket 250 may be fixed to the panes of glass 402, 403 using an adhesive such as adhesive tape or glue such as butyl.

**[0103]** Each door is fitted with a gasket system 200 (as described above in relation to figures 2 and 3) disposed at the distal longitudinal ends, i.e. end faces, of the doors relative to the door's hinges. The gasket systems 200 each extend vertically from the top of the door to the bottom of the door.

**[0104]** With the doors 400, 410 in the closed position as shown in figure 4, the magnet 240 of each respective gasket system 200 is attracted to the magnet 240 of the other gasket system 200. The attractive force overcomes the biasing of the bellows 230 and causes each bellow 230 to extend from the stowed position to the sealing position such that the magnets 240 are in contact with each other to form the seal. The magnets 240 and bellows 230 of each gasket 200 therefore together create a barrier across the gap 420 between the doors 400, 410 in order to prevent air from passing from the area on the forward side of the doors 400, 410 and the area on the aft side of the doors 400, 410 or vice versa.

**[0105]** The gasket system 200 can also be used to provide a seal between a surface such as a wall, frame or door which does not comprise a second gasket system 200. The magnet 240 of the gasket system 200 can hence form a seal with another magnetically attractive surface. In a scenario in which one gasket system 200 is used to provide a reversible seal between a door and a stationary surface such as a wall or a frame, the gasket system 200 can be provided on either the stationary surface or the door. Similarly, in some uses of the gasket system 200, only one gasket system 200 is required to provide a reversible seal between two doors. This may be possible for example if the door without the gasket system 200 has a magnetically attractive strip on the end of the door



that faces the surface of the door with the gasket system 200 when the doors are in a closed position.

**[0106]** Figure 5 shows a bracket 250 of the gasket system 200 set into a door 400 comprised of a double-glazed panel 401. The bracket 250 may be glued to the door. The bracket is inserted between a first pane of glass 402 and a second pane of glass 403 in order to assist in maintaining the gap between the first and second panes of glass 402, 403. The bracket 250 may also act to seal the insulating layer 404, e.g. air gap, provided between the first and second panes of glass 402, 403. A spacer 405 may also be provided to assist in the formation of the double glazed panel 401 as described above. The bracket 250 and the spacer 405 are made from a transparent material, such as PVC, so that the transparent effect of the glass double-glazed panel is not obscured.

**[0107]** Figure 6 shows a bellow 230, and magnet 240 removed from the bracket 250. The bellow 230 may comprise flexible pleated sides and hence the deformation experienced as the bellow 230 extends from the stowed position to the sealing position and back again may easily be taken up by a shape change in the material.

**[0108]** Figure 7 also shows an example bellow 230 and magnet 240 removed from the bracket 250. The sides of the bellow 230 in this case includes corrugations 238. The material of the bellow 230 deforms about the folds of the corrugations 238 when extending from the stowed position to the sealing position and back again. The elastic deformation may hence be controlled to a greater degree than without the corrugations.

**[0109]** Figure 8 shows parts of two doors 400, 410 each being rotated about their respective hinges (not shown) towards a closed position. In the position shown in figure 8, the two gasket systems 200 are not engaged. This means that each gasket system 200 is shown in the stowed position (in this case with the front surface of the magnet 240 in line with the front surface of the bracket 250). This is because the doors 400, 410, are not yet in close enough proximity for the attractive force of the magnets 240 to overcome the resilient bias of the bellows 230 towards the stowed position.

**[0110]** Figure 9 shows the two doors 400, 410 of figure 8 once they are in the closed position. In this position the magnets 240 of the gasket systems 200 are in close enough proximity for the magnetic attractive forces there between to overcome the resilient bias of the bellows 230. This means that the bellows 230 are extended into the sealing position and the magnets 240 together form a seal therebetween.

**[0111]** Figure 10 shows an example refrigeration unit 1001 in which the gasket system 200 described herein may be used. This example unit 1001 comprises three pairs of French doors.

**[0112]** This figure shows seven exemplary locations where one or a pair of the gasket systems 200 may be used. These are between the opening surfaces of the pairs of doors or between the rear end face of the door near where the hinge is located and the hinge surface.

In the case that the location is shown as having a single gasket system 200, there would be a magnetically attractive surface for the gasket system 200 to seal with when in the sealing position.

**[0113]** Additionally, although not shown, the gasket system 200 could additionally or alternatively be provided on the top and bottom horizontal surfaces of each door.

**[0114]** In this figure the gasket systems 200 are each shown in cross section plan view but they would each extend longitudinally between the ends surfaces of the doors or the door and hinge surface.

## Claims

1. A gasket system (200) for providing a reversible seal between a first surface and a second surface of a refrigerator unit, wherein the first surface and/or the second surface are moveable relative to the other of the two surfaces, the gasket system (200) comprising:

a bellow (230) comprising an inner portion and a distal portion;

a magnet (240) disposed at the distal portion of the bellow (230); and

a bracket (250) for attaching the bellow (230) to the first surface, wherein the bracket (250) comprises an open ended cavity (251);

wherein the inner portion of the bellow (230) is arranged to be connected to the inner surface of the cavity (251) of the bracket (250) opposite the open end of the cavity (251);

wherein, when the bellow (230) is connected to the bracket (250), the bellow (230) is movable between a stowed position and a sealing position;

wherein, in the stowed position the bellow (230) is retracted so as to be disposed completely within the cavity (251) of the bracket (250), and in the sealing position the bellow (230) extends from the cavity (251); and

wherein the bellow (230) is resiliently biased towards the stowed position.

2. A gasket system (200) as claimed claim 1, wherein the bellow (230) is longitudinally extending and the magnet (240) extends along the length of the bellow (230).

3. A gasket system (200) as claimed in claim 1 or 2, wherein the bracket (250) and/or bellow (230) is transparent.

4. A gasket system (200) as claimed in any of claims 1, 2 or 3, wherein the bracket (250) and/or bellow (230) is composed of a plastic.

5. A gasket system (200) as claimed in any preceding claim, wherein the bellow (230) is comprised of an elastically deformable material, and the elastically deformable material provides the resilient bias. 5
6. A gasket system (200) as claimed in any preceding claim, wherein
  - the bellow (230) comprises a fixing piece (237) at the inner end, and 10
  - the bracket (250) comprises a slot (254) on the inner surface (252) of the cavity (251) opposite the open end of the cavity (251), and
  - wherein the bellow (230) is affixed to the bracket (250) by the fixing piece (237) being inserted into the slot (254). 15
7. A sealing system for a refrigerator unit (1001), wherein the sealing system comprises: 20
  - a first surface;
  - a second surface provided with a magnetically attractive surface, wherein the first and/or second surfaces are movable to a closed position in which the first and second surfaces are at their closest approach; and 25
  - a first gasket system (200) according to any of the preceding claims attached to the first surface for providing a reversible seal between the first surface and the second surface when the first and second surfaces are in the closed position. 30
8. A sealing system as claimed in claim 7, wherein the magnetically attractive surface of the second surface is provided by a second gasket system (200) according to any of claims 1 to 6. 35
9. A sealing system as claimed in claim 7 or 8, wherein the first surface is a surface of a first door, and the second surface is either a surface of a second door or a surface of a wall or frame. 40
10. A sealing system as claimed in claim 9, wherein the first surface is moveable relative to the second surface via rotation of the first and/or second door about a hinge. 45
11. A sealing system as claimed in claim 9 or 10, wherein the gasket system (200) is arranged to provide a seal for an air gap (404) between two panes (402, 403) of a double-glazed door (400, 410). 50
12. A refrigerator unit (1001) comprising one or more sealing system(s) (200) according to any of claims 7 to 11. 55
13. A refrigerator unit as claimed in claim 12, wherein the refrigerator unit is a multideck refrigerator display cabinet (1001).
14. A method of providing a reversible seal between a first surface and a second surface of a refrigerator unit, wherein the first surface and/or second surface is moveable relative to the other of the two surfaces, the method comprising:
  - providing a gasket system (200) on the first surface, the gasket system (200) comprising a bellow (230) comprising an inner portion and a distal portion; a magnet (240) disposed at the distal portion of the bellow (230); and a bracket (250) comprising an open ended cavity (251), wherein the bellow (230) is attached at its distal portion to the bracket (250), wherein the gasket system (200) is attached to the first surface via the bracket (250), and wherein the bellow (230) is for extending across a gap between the first and second surfaces when the first and second surfaces are in a closed position; 5
  - resiliently biasing the bellow (230) to a stowed position in which the bellow (230) is retracted and disposed completely within the cavity (251) of the bracket (250);
  - moving the first and/or second surfaces to a closed position at which they are at their closest approach such that the magnet (240) engages with the second surface, and as a result, the bellow (230) extends from the cavity into a sealing position; and
  - moving the first and second surface away from the closed position such that the magnet (240) disengages with the second surface and, as a result of the biasing, the bellow (230) returns to the stowed position.
15. A method as claimed in claim 14, wherein the gasket system (200) is the gasket system (200) of any of claims 1 to 6.

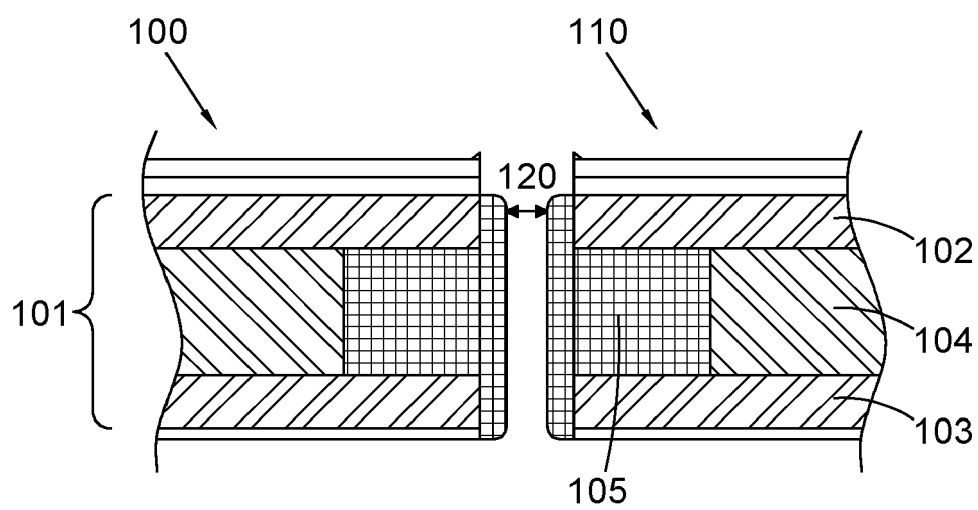


FIG. 1

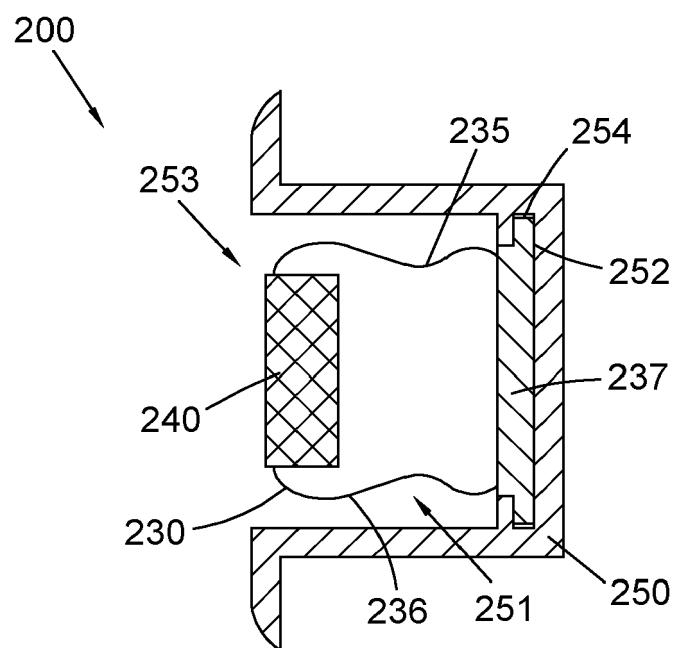


FIG. 2

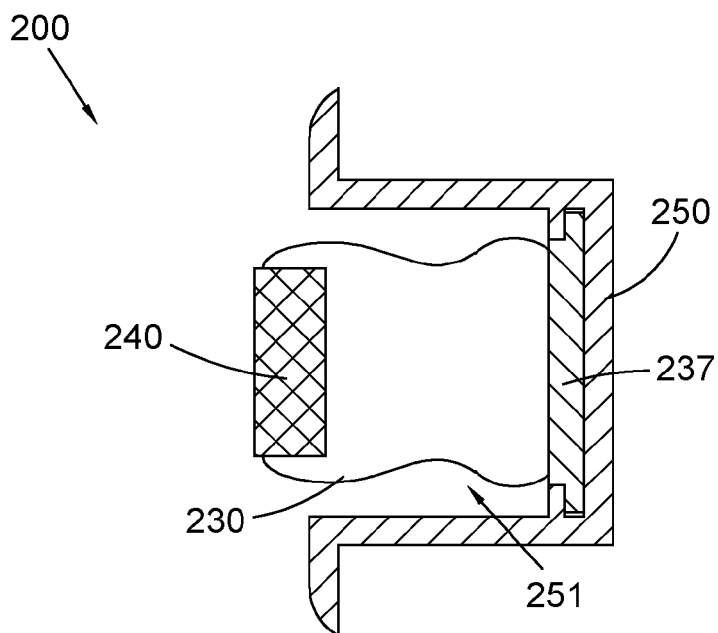


FIG. 3

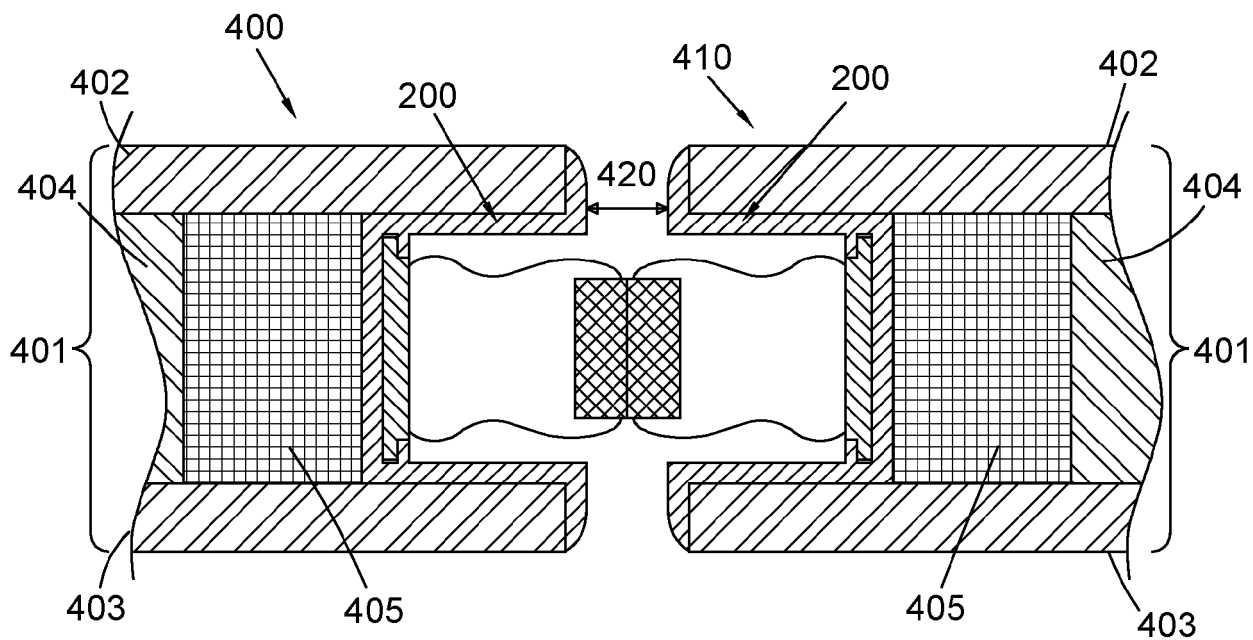


FIG. 4

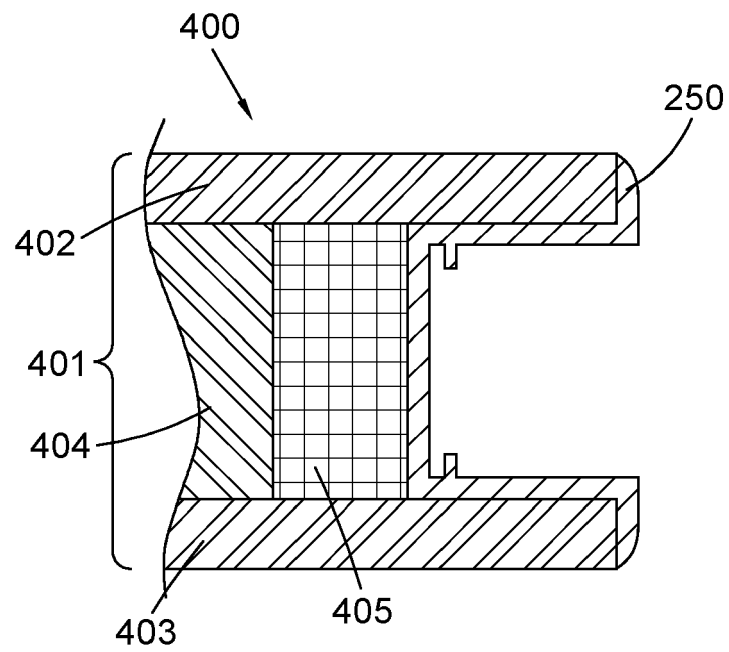


FIG. 5

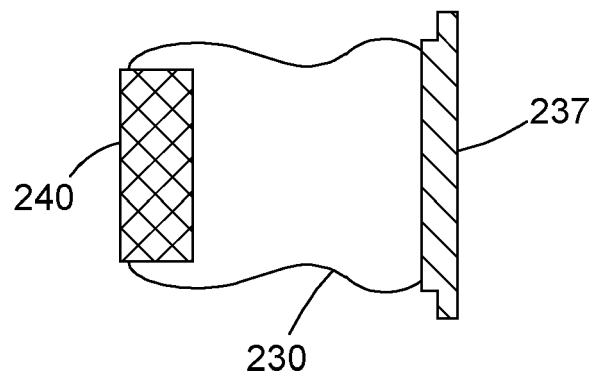


FIG. 6

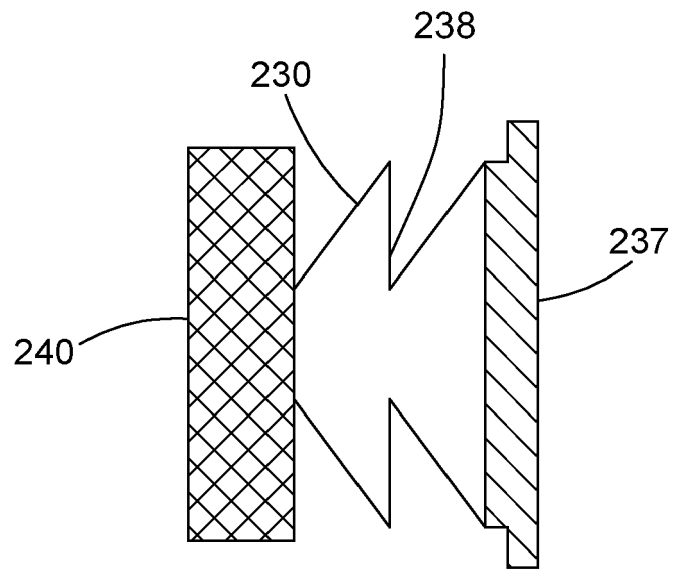


FIG. 7

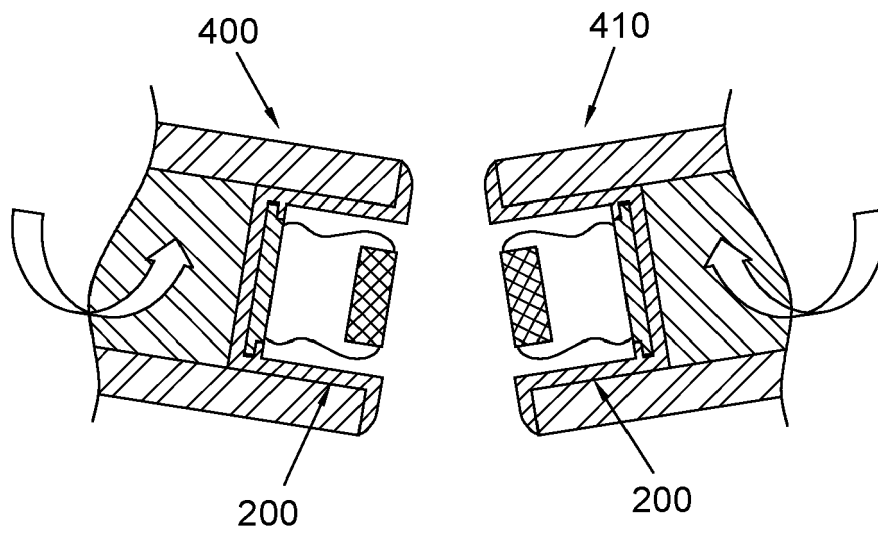


FIG. 8

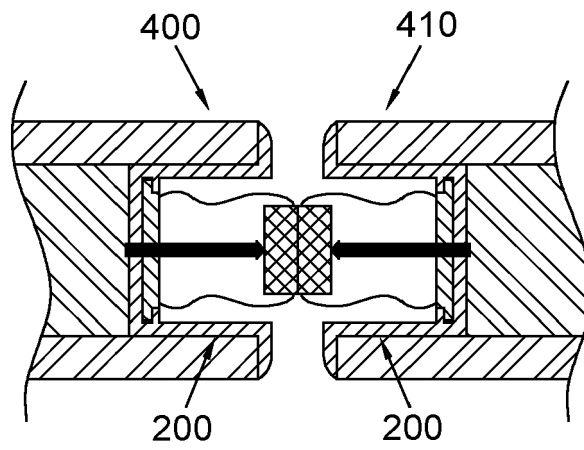


FIG. 9

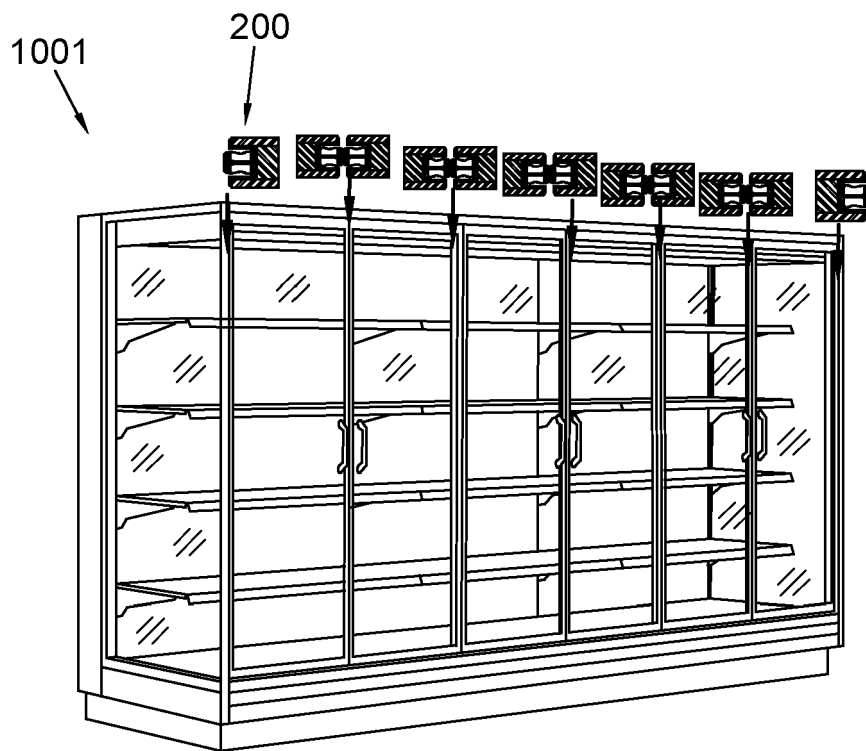


FIG. 10



## EUROPEAN SEARCH REPORT

Application Number

EP 22 16 3593

## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2019/274451 A1 (TWOHY RAYMOND P [US] ET AL) 12 September 2019 (2019-09-12)	1, 2, 4-15	INV. F25D23/08
A	* paragraph [0117]; figures 27-28 * -----	3	A47F3/04
Y	US 5 975 661 A (JEZIOROWSKI LES [CA] ET AL) 2 November 1999 (1999-11-02)	1, 2, 4-15	ADD. F25D23/02
	* column 8, lines 32-34; figures 4-5 * -----		
Y	US 3 221 375 A (LEWIS JAMES C ET AL) 7 December 1965 (1965-12-07)	1	
	* column 3, lines 43-58; figures 2-3 * -----		
Y	DE 10 2016 203323 A1 (BSH HAUSGERAETE GMBH [DE]) 7 September 2017 (2017-09-07)	1	
	* figure 4 * -----		
A	DE 695 06 206 T2 (RONDA EUROPA SPA [IT]) 6 May 1999 (1999-05-06)	1-15	
	* figure 5 * -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F25D A47F

1

EPO FORM 1503 03.82 (P04C01)

Place of search

The Hague

Date of completion of the search

24 August 2022

Examiner

Canköy, Necdet

## CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone  
Y : particularly relevant if combined with another document of the same category  
A : technological background  
O : non-written disclosure  
P : intermediate document

T : theory or principle underlying the invention  
E : earlier patent document, but published on, or after the filing date  
D : document cited in the application  
L : document cited for other reasons

& : member of the same patent family, corresponding document



**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 16 3593

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-08-2022

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 2019274451	A1	12-09-2019	AU	2016427789 A1		02-05-2019
			AU	2020264293 A1		26-11-2020
			CA	3041774 A1		03-05-2018
			NZ	752375 A		25-09-2020
			US	2019274451 A1		12-09-2019
			WO	2018080482 A1		03-05-2018
-----						
US 5975661	A	02-11-1999	CA	2231319 A1		05-09-1999
			EP	0940643 A2		08-09-1999
			JP	H11287548 A		19-10-1999
			KR	19990077579 A		25-10-1999
			US	5975661 A		02-11-1999
-----						
US 3221375	A	07-12-1965	NONE			
-----						
DE 102016203323	A1	07-09-2017	NONE			
-----						
DE 69506206	T2	06-05-1999	DE	69506206 T2		06-05-1999
			EP	0705415 A1		10-04-1996
			IT	VI940016 U1		22-10-1995
			WO	9529373 A1		02-11-1995
-----						