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(54) **Refrigerator door assembly and method**

Kühlschranttüranordnung und Verfahren

Dispositif et procédé pour porte de réfrigérateur

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(73) Proprietors:
• **Barroero, Louis**
San Leandro, California 94577 (US)
• **Rivers, John P.**
Livermore, California 94550 (US)

(72) Inventors:
• **Barroero, Louis**
San Leandro, California 94577 (US)

• **Rivers, John P.**
Livermore, California 94550 (US)

(74) Representative:
Harrison, David Christopher et al
MEWBURN ELLIS
York House
23 Kingsway
London WC2B 6HP (GB)

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Description

[0001] This invention relates generally to a refrigeration unit and more particularly to a unitized refrigerator door assembly therefor.

[0002] Conventional window-type door assemblies for refrigeration units of the type used in supermarkets and the like comprise a frame having a thermo-pane mounted therein. The frame is composed of extruded aluminum frame members secured together by corner brackets. The thermo-pane normally comprises a pair of glass plates suitably spaced apart by spacer members disposed about the peripheries of the plates. An elastomeric gasket is secured between the frame and the edges of the plates in a conventional manner.

[0003] Standard door assemblies of this type are expensive to fabricate and assemble due to the large number of component parts involved and the labor intensive steps required for the assembly process. Further, a relatively high thermal conductivity exhibited by the aluminum frame that induces undue conduction of heat within the refrigeration unit. In addition, an electrical heating system is normally required to prevent condensation on the glass plates composing the thermo-pane. The door assemblies also normally require the consumer-customer to close them manually, after it they have been opened for product procuring purposes.

[0004] An object of this invention is to overcome the above, briefly described problems encountered with conventional door assemblies for refrigeration units by providing an economical refrigerator door assembly that exhibits a high degree of structural integrity and efficiency when placed in operation. This is achieved by a refrigerator door assembly having the features of claim 1.

[0005] In US-A-4084347, a door assembly which may be used with a refrigerator comprises a door frame and aligned hinge pins molded within the door frame for mounting the door assembly for pivotal movement about a common pivot axis on a stationary frame of a refrigeration unit, and in US-A-4753043, which discloses a refrigerator door assembly which has the features of the preamble of claim 1, a torsion means functions to constantly apply a closing force on the door assembly. In contrast, in the present invention, while both the hinge pins and the torsion means is molded in the door assembly during moulding, the hinge pin(s) to which the torsion means is connected is twistable in the finished frame.

[0006] In still another aspect of this invention, a method for making the refrigerator door assembly is taught which includes injecting a liquified thermo plastic or thermosetting plastic material into a mold cavity to form the door frame and curing and hardening the plastic material to form a structurally integrated refrigerator door assembly including a torsion means connected to a hinge pin which remains twistable within the cured

and hardened frame by virtue of having been coated with a release coating.

[0007] In the drawings:

Figure 1 is an isometric view illustrating a mounting frame for a refrigeration unit having a refrigerator door assembly of this invention hingedly mounted thereon;

Figure 2 is a partially sectioned, enlarged view illustrating upper and lower hinge assemblies mounting the refrigerator door assembly on the frame of the refrigeration unit;

Figure 3 is an isometric view illustrating a combined hinge pin and adjustable torsion bar that is molded and structurally integrated within a door frame of the refrigerator door assembly;

Figure 4 is an enlarged sectional view partially illustrating the sealed disposition of a thermo-pane and torsion bar in the door frame and a static magnetic seal between the frame of the refrigeration unit and the door frame when the refrigerator door assembly is in its closed position; and

Figure 5 is a sectional view partially illustrating a two-part mold assembly adapted to structurally integrate the thermo-pane, torsion bar and door frame during an injection molding process.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0008] Figure 1 illustrates a stationary metallic mounting frame 10 of a refrigeration unit (not fully shown) of the commercial or domestic type. A refrigerator door assembly 11 is hingedly mounted on frame 10 by upper and lower hinge assemblies 12 and 13, respectively, for pivotal movement about a common pivot axis X (Figure 2). As described more fully hereinafter, a second refrigerator door assembly is adapted to be hingedly mounted on the opposite side of frame 10 in a conventional manner. As will be obvious to those skilled in the refrigeration arts, the frame can be constructed in accordance with the teachings of this invention to mount one, two or more left and/or right handed (Figure 1) door assemblies thereon, depending on the particular commercial or domestic application under consideration.

[0009] Each door assembly 11 comprises a transparent thermo-pane 14 having a door frame 15 integrally molded thereabout and in sealing relationship therewith, as described more fully hereinafter with reference to Figures 4 and 5. As shown in Figure 2, upper and lower hinge assemblies 12 and 13 comprise vertically aligned upper and lower hinge pins 16 and 17, respectively. A torsion means 18 (Figure 3) is connected to at least one of the upper and lower hinge pins for constantly applying a closing force F (Figure 1) on door frame 15 to pivot the refrigerator door assembly towards its normal, closed position on mounting frame 10.

[0010] As shown in Figures 2-4, the torsion means

is molded within the door frame to be structurally integrated therewith and comprises a steel torsion bar 19. As shown in Figure 2, the upper end of upper hinge pin 16 projects beyond an upper end of door frame 15 and an upper end of torsion bar 19 is secured to a lower end of pin 16. As shown in Figures 3 and 4, torsion bar 19 preferably has a square cross-section and an outer dimension slightly larger than a bore 20, preformed in pin 16 prior to the force-fitting or swaging of the torsion bar into the bore. In particular, the torsion bar is forced into the bore to plastically deform the contacting metal surfaces whereby the torsion bar and pin will be secured together for simultaneous rotation and twisting.

[0011] As shown in Figure 2, a main body of torsion bar 19 is disposed on common pivot axis X of pins 16 and 17 and a lower end 21 of the torsion bar is bent to provide an anchoring leg 21 (Figure 3) embedded in the door frame and disposed transversely relative to the axis. The dimensional parameters of the torsion bar, including its length and the location along the vertical height of door assembly 11 whereat anchoring leg 21 of the torsion bar is located (e.g., one-fourth of the length of the door assembly), as well as its composition, will be primarily dictated by the size and mass of the door assembly requiring a particular automatic closing force. As further shown in Figures 2 and 3, the torsion bar is preferably covered with a plastic sheath 22 to permit the torsion bar to twist within the sheath and relative to encapsulating door frame 15.

[0012] During the hereinafter described molding process, upper hinge pin 16 is preferably coated with a standard release agent to prevent the steel pin from adhering to the surrounding plastic material composing door frame 15. An adjustment means 23 is provided between upper hinge pin 16 and an upper hinge bracket 24, seamed to frame 10, of upper hinge assembly 12 for manually and selectively setting the magnitude of closing force F (Figure 1) imposed on the door assembly. In the embodiment illustrated, adjustment means 23 comprises a collar 25 mounted on the upper end of hinge pin 16 and welded or otherwise suitably secured to upper hinge bracket 24.

[0013] A hexagonal socket 26 is formed in the proximal or upper end of pin 16 to adapt it for reception of a standard Allen head wrench whereby the pin can be rotated to selectively adjust the closing force imposed on the door assembly by torsion bar 19. A plurality of circumferentially spaced and radially extending bores 27 are formed in collar 25 for alignment with a plurality of like-formed bores 28, formed in the upper end of pin 16, for the reception of a locking pin 29 (Figure 2). The bores and locking pin thus provide means for locking hinge pin 16 in a selected rotative position relative to collar 25 when the pin is rotated to impose the desired closing force on the door assembly.

[0014] As shown in Figure 2, lower hinge assembly 13 comprises a lower hinge bracket 31 suitably secured on stationary mounting frame 10 to have the lower end

of lower hinge pin 17 pivotally mounted thereon. The upper end of pin 17 is suitably secured within molded door frame 15. The pin is rotatably mounted within an externally threaded first nut 32 having an upper flange 33 overlying lower hinge bracket 31. The nut extends through an elongated slot 34, formed through bracket 31, and is secured in place by an internally threaded second nut 35 and a lock washer 36. Thus, means are provided for securing lower hinge pin 17 in an adjusted side-to-side position within slot 34 for vertically orientating common pivot axis X for vertically aligned pins 16 and 17, e.g., to adjust for "door sag."

[0015] As shown in Figure 4, thermo-pane 14 comprises a pair of spaced-apart window panes or glass plates 37, preferably tempered and pre-treated in a conventional manner for refrigerator door applications. A sealing strip 38 is disposed between and about the periphery of the glass plates and is integrally molded within door frame 15. The sealing strip comprises a metallic spacer 39 that encapsulates a silica gel material 40 and an elastomeric (natural or synthetic rubber) gasket 41 covering the outer edges of the sealing strip and glass plates. The space between glass plates 37 can be evacuated or filled with an inert thermal insulating gas, as is well-known to those skilled in the art.

[0016] A groove 42 is formed in an inner side of door frame 15 to extend about the frame and has an elastomeric gasket 43 preformed therein. A magnetic strip and seal means 44 is press-fit and secured in groove 42 for maintaining the refrigerator door assembly in closed and sealed relationship on stationary mounting frame 10. The magnetic strip and seal means comprises an elastomeric member, including a generally U-shaped anchoring stem 45 compressed within groove 42 and a bellows-type elastomeric gasket 46 having a magnetic strip 47 secured therein. A metallic tape 48 in strip-form is suitably secured on the outer face of mounting frame 10 (Figures 1 and 4) to cooperate with magnetic strip 47 to hold the refrigerator door assembly in sealing relationship on the frame when the door assembly is moved automatically, by the force imposed thereon by torsion rod 19, to its normally closed position on frame 10.

[0017] Figure 5 partially illustrates a two-part mold assembly 49 utilized for carrying forth the method steps for making structurally integrated refrigerator door assembly 11. The method comprises positioning thermo-pane 14, having sealing strip 38 suitably secured between glass plates 37, within a mold cavity 50, along with hinge pins 16 and 17, torsion bar 19 and covering sheath 22, and elastomeric gasket 43. Elastomeric (rubber) sheets 53 are preferably disposed between glass plates 37 and the mold parts for glass protection purposes. A liquified thermo-plastic or thermo-setting plastic material of a suitable type is then injected into mold cavity 50 in a conventional manner to form door frame 15 in sealing relationship about thermo-pane 14 and to structurally integrate the

thermo-pane, hinge pins and torsion bar within the frame. As suggested above, a suitable release agent is coated onto hinge pin 16 prior to the molding process to insure that the pin is allowed to twist within the door frame after it has been allowed to cure and harden.

[0018] After the completed refrigerator door sub-assembly has been completed, magnetic strip and seal assembly 44 is suitably secured within groove 42 about the periphery of the door frame and hinge pins 16 and 17 are mounted in upper and lower hinge brackets 24 and 31, respectively. During installation, lower hinge pin 17 can be adjusted by the selective loosening and tightening of nut 35 (Figure 2) to ensure vertical orientation of hinge pins 16 and 17. Further, an Allen wrench is applied to socket 26, prior to installation of locking pin 29, to set the desired torsional force on torsion bar 19 in the manner described above.

[0019] The plastic material composing molded door frame 15 may be of any suitable type. For example, the plastic material composing the door frame may comprise ABS (three-monomer system composed of acrylonitrile, butadiene and styrene), OSA (olefin-modified styrene-acrylonitrile) acetal copolymer, glass-reinforced high impact acrylic, or other suitable plastic resin material adapted for refrigerator door applications of the type described herein. Although refrigerator door assembly 11 is described as having a thermo-pane 14, it should be understood that it could be formed solid for certain refrigeration applications. Suitable screw-type inserts (not shown) could also be integrally formed within the door frame for subsequent attachment of a standard handle 54 thereon (Figure 1). The door frame can be permanently colored by adding a standard coloring pigment to the liquified plastic material during the molding process.

Claims

1. A refrigerator door assembly (11) adapted to be mounted on a stationary frame (10) of a refrigeration unit comprising:

a door frame (15);

aligned hinge pins (16,17) located in said door frame (15) for mounting said door assembly (11) for pivotal movement about a common pivot axis (X) on the stationary frame (10) of said refrigeration unit,

torsion means (18) connected to at least one of said hinge pins (16,17) for constantly applying a closing force (F) on said door frame (15) to pivot said door assembly (11) about said common pivot axis (X), characterized in that:

said door frame (15) is molded,

said hinge pins (16,17) are embedded in said molded door frame (15) during its molding,

said hinge pin (16) connected to said torsion means (18) is twistable within the door frame (15) after the door frame (15) has been allowed to cure and harden,

said torsion means (18) is embedded within said molded door frame (15) during its molding.

2. A refrigerator door assembly according to claim 1 wherein said torsion means comprises a torsion bar (19).
3. A refrigerator door assembly according to claim 2 wherein one of said hinge pins is an upper pin (16) having an upper end projecting beyond an upper end of said door frame (15) and wherein an upper end of said torsion bar (19) is secured to a lower end of said upper pin.
4. A refrigerator door assembly according to claim 3 wherein the other of said hinge pins comprises a lower pin (17) having a lower end projecting beyond a lower end of said door frame (15).
5. A refrigerator door assembly according to claim 3 or claim 4 wherein a main body of said torsion bar is disposed on said common pivot axis (X) and a lower end of said torsion bar is bent to provide an anchoring leg (21) disposed transversely relative to said axis.
6. A refrigerator door assembly of claim 5 further comprising a sheath means (22) covering the main body of said torsion bar (19) for permitting the main body of said torsion bar to twist relative to said door frame.
7. A refrigerator door assembly of any one of the preceding claims comprising adjustment means (23) for selectively setting the magnitude of said closing force.
8. A refrigerator door assembly according to any one of the preceding claims further comprising a thermo-pane (14) integrally molded in sealing relationship within said door frame (15), said thermo-pane comprising a pair of spaced-apart window panes (37) and a sealing strip (38) disposed between and about the periphery of said window panes, said sealing strip being molded within said door frame.
9. A method for making a refrigerator door assembly according to claim 1 including comprising:

placing aligned hinge pins (16,17) in a mold cavity defining the shape of a door frame (15);

securing a torsion means (18) to at least one of said hinge pins and coating the said pin(s) with a release agent; 5

injecting a liquid plastic material into said mold cavity around the pins and torsion means to form a door frame in which said torsion means and pins are molded; and 10

curing and hardening said plastic material to form a structurally integrated refrigerator door assembly (11) including said pins (16,17) and said torsion means (18), said coated pin(s) secured to the torsion means being twistable within the cured and hardened frame. 15

10. A method according to claim 9 which further includes: 20

positioning a thermo pane (14) having a pair of spaced-apart window panes (37), having a static thermal sealing strip (38) therearound, in said mold cavity; and 25

injecting the liquid plastic material to integrate also the thermo pane (10) in the frame. 30

Patentansprüche

1. Kühlschranktüranordnung (11), die zum Montieren auf einem stationären Rahmen (10) einer Kühleinheit ausgebildet ist, umfassend: 35

einen Türrahmen (15);

ausgerichtete Gelenkbolzen (16, 17), die im Türrahmen (15) angeordnet sind, um die Türanordnung (11) zur Schwenkbewegung um eine gemeinsame Schwenkachse (X) auf dem stationären Rahmen (10) der Kühleinheit zu montieren, 40

Torsionsmittel (18), die mit zumindest einem der Gelenkbolzen (16, 17) verbunden sind, um konstant eine Schließkraft (F) auf den Türrahmen (15) auszuüben, um die Türanordnung (11) um die gemeinsame Schwenkachse (X) zu schwenken, 45
dadurch gekennzeichnet, dass der Türrahmen (15) geformt ist, 50

die Gelenkzapfen (16, 17) während des Formens im geformten Türrahmen (15) eingebettet werden, 55

der mit dem Torsionsmittel (18) verbundene Gelenkbolzen (16) innerhalb des Türrahmens (15) verdrehbar ist, nachdem der Türrahmen (15) gehärtet und verfestigt ist,

das Torsionsmittel (18) im geformten Türrahmen (15) eingebettet wird, während dieser geformt wird.

2. Kühlschranktüranordnung nach Anspruch 1, worin das Torsionsmittel einen Torsionsstab (19) umfasst.

3. Kühlschranktüranordnung nach Anspruch 2, worin einer der Gelenkbolzen ein oberer Bolzen (16) mit einem oberen Ende ist, das über ein oberes Ende des Türrahmens (15) hinausragt, und worin ein oberes Ende des Torsionsstabes (19) an einem unteren Ende des oberen Bolzens befestigt ist.

4. Kühlschranktüranordnung nach Anspruch 3, worin der andere der Gelenkbolzen ein unterer Bolzen (17) mit einem unteren Ende ist, das über ein unteres Ende des Türrahmens (15) hinausragt.

5. Kühlschranktüranordnung nach Anspruch 3 oder 4, worin ein Hauptkörper des Torsionsstabes auf der gemeinsamen Schwenkachse (X) angeordnet ist und ein unteres Ende des Torsionsstabes gebogen ist, um einen Verankerungsschenkel (21) bereitzustellen, der in Querrichtung in Bezug auf die Achse angeordnet ist.

6. Kühlschranktüranordnung nach Anspruch 5, weiters umfassend eine Ummantelung (22), die den Hauptkörper des Torsionsstabes (19) umgibt und es ermöglicht, dass sich der Hauptkörper des Torsionsstabes in Bezug auf den Türrahmen verdreht.

7. Kühlschranktüranordnung nach einem der vorangegangenen Ansprüche, die Einstellmittel (23) umfasst, um die Größe der Schließkraft selektiv einzustellen.

8. Kühlschranktüranordnung nach einem der vorangegangenen Ansprüche, weiters umfassend ein Thermopanglas (14), das einstückig mit dem Türrahmen (15) in dichtender Beziehung damit geformt ist, wobei das Thermopanglas ein Paar beabstandeter Fensterscheiben (37) und einen Dichtungstreifen (38) umfasst, der zwischen und um den Umfang der Fensterscheiben angeordnet ist, wobei der Dichtungstreifen innerhalb des Türrahmens geformt ist.

9. Verfahren zur Herstellung einer Kühlschranktüranordnung nach Anspruch 1, umfassend:

das Anordnen ausgerichteter Gelenkbolzen

(16, 17) in einem Formhohlraum, der die Gestalt eines Türrahmens (15) definiert;

das Befestigen eines Torsionsmittels (18) an zumindest einem der Gelenkbolzen und das Beschichten des Bolzens bzw. der Bolzen mit einem Formtrennmittel;

das Einspritzen eines flüssigen Kunststoffmaterials in den Formhohlraum um die Bolzen und das Torsionsmittel herum, um einen Türrahmen auszubilden, in dem das Torsionsmittel und die Bolzen eingeformt sind; und

das Härten und Verfestigen des Kunststoffmaterials, um eine Külschranktüranordnung (11) mit einstückiger Struktur zu bilden, die die Bolzen (16, 17) und das Torsionsmittel (18) umfasst, wobei der/die am Torsionsmittel befestigte(n) beschichtete(n) Bolzen innerhalb des gehärteten und verfestigten Rahmens verdrehbar ist/sind.

10. Verfahren nach Anspruch 9, weiters umfassend:

das Anordnen eines Thermopanglases (14) mit einem Paar voneinander beabstandeter Fensterscheiben (37), um das herum sich ein statischer Wärmedichtungsstreifen (38) befindet, im Formhohlraum; und

das Einspritzen des flüssigen Kunststoffmaterials, um auch das Thermopanglas (10) einstückig im Rahmen zu integrieren.

Revendications

1. Ensemble de porte de réfrigérateur (11) apte à être installé sur un châssis stationnaire (10) d'une unité de réfrigération comprenant :

un châssis de porte (15) ;

des axes d'articulation alignés (16, 18) situés dans ledit châssis de porte (15) pour le montage dudit ensemble de porte (11) en vue d'un mouvement pivotant autour d'un axe de pivotement commun (X) sur le châssis stationnaire (10) de ladite unité de réfrigération,

un moyen de torsion (18) relié à au moins l'un desdits axes d'articulation (16, 17) pour appliquer constamment une force de fermeture (F) sur ledit châssis de porte (15) pour faire pivoter ledit ensemble de porte (11) autour dudit axe de pivotement commun (X), caractérisé en ce que :

ledit châssis de porte (15) est moulé,

lesdits axes d'articulation (16, 17) sont noyés dans ledit châssis de porte moulée (15) pendant son moulage,

ledit axe d'articulation (16) relié audit moyen de torsion (18) peut être tordu dans le châssis de porte (5) après que le châssis de porte (5) a pu se polymériser et durcir,

ledit moyen de torsion (18) est noyé dans ledit châssis de porte moulé (15) pendant son moulage.

2. Ensemble de porte de réfrigérateur selon la revendication 1, dans lequel ledit moyen de torsion comprend une barre de torsion (19).
3. Ensemble de porte de réfrigérateur selon la revendication 2, dans lequel l'un desdits axes d'articulation est un axe supérieur (16) ayant une extrémité supérieure dépassant au-delà d'une extrémité supérieure dudit châssis de porte (15), et dans lequel une extrémité supérieure de ladite barre de torsion (19) est fixée à une extrémité inférieure dudit axe supérieur.
4. Ensemble de porte de réfrigérateur selon la revendication 3, dans lequel l'autre desdits axes d'articulation comprend un axe inférieur (17) ayant une extrémité inférieure faisant saillie au-delà d'une extrémité inférieure dudit châssis de porte (15).
5. Ensemble de porte de réfrigérateur selon la revendication 3 ou la revendication 4, dans lequel un corps principal de ladite barre de torsion est disposé sur ledit axe de pivotement commun (X), et une extrémité inférieure de ladite barre de torsion est pliée pour réaliser une branche d'ancrage (21) disposée transversalement relativement audit axe.
6. Ensemble de porte de réfrigérateur selon la revendication 5, comprenant en outre un moyen formant gaine (22) couvrant le corps principal de ladite barre de torsion (19) pour permettre au corps principal de ladite barre de torsion de se tordre par rapport audit châssis de porte.
7. Ensemble de porte de réfrigérateur selon l'une des revendications précédentes, comprenant un moyen d'ajustage (23) pour régler sélectivement la grandeur de ladite force de fermeture.
8. Ensemble de porte de réfrigérateur selon l'une des revendications précédentes, comprenant en outre un verre Thermopane (14) moulé intégralement selon une relation étanche avec ledit châssis de

porte (15), ledit verre Thermopane comprenant une paire de vitres espacées (37) et une bande d'étanchéité (38) disposée entre et autour de la périphérie desdites vitres, ladite bande d'étanchéité étant moulée dans ledit châssis de porte.

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9. Procédé de fabrication d'un ensemble de porte de réfrigérateur selon la revendication 1, comprenant les étapes consistant à :

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placer des axes d'articulation alignés (16, 17) dans une cavité de moule définissant la forme d'un châssis de porte (15) ;

fixer un moyen de torsion (18) à au moins l'un desdits axes d'articulation et revêtir le ou les axes précités d'un agent de séparation ;

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injecter une matière plastique liquide dans ladite cavité de moule autour des axes et du moyen de torsion pour former un châssis de porte dans lequel lesdits moyens de torsion et axes sont moulés ; et

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polymériser et durcir ladite matière plastique pour former un ensemble de porte de réfrigérateur (11) structurellement intégré incluant lesdits axes (16, 17) et ledit moyen de torsion (18), le ou les axes revêtus précités, fixés au moyen de torsion, pouvant être tordus dans le châssis polymérisé et durci.

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10. Procédé selon la revendication 9, qui comprend en outre les étapes consistant à :

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positionner un verre Thermopane (14) comportant une paire de vitres espacées (37), ayant une bande d'étanchéité thermique statique (38) autour de celles-ci, dans ladite cavité de moule ; et

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injecter la matière plastique liquide pour intégrer également le verre Thermopane (10) dans le châssis.

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