United States Patent

[11] 3,628,845

[72] Inventor **Bernard J. Grimm**
Louisville, Ky.

[21] Appl. No. **36,283**
[22] Filed **May 11, 1970**
[73] Assignee **General Electric Company**

[54] **REFRIGERATOR CABINET WITH SELF-CLOSING DOOR**
1 Claim, 5 Drawing Figs.

[52] U.S. Cl. **312/319,** 312/138, 16/153
[51] **Int. Cl.** **E05f 1/02**
[50] **Field of Search** ..... 312/138, 138 A, 213, 214, 319; 16/153, 160, 154, 152

[56] **References Cited**

UNITED STATES PATENTS

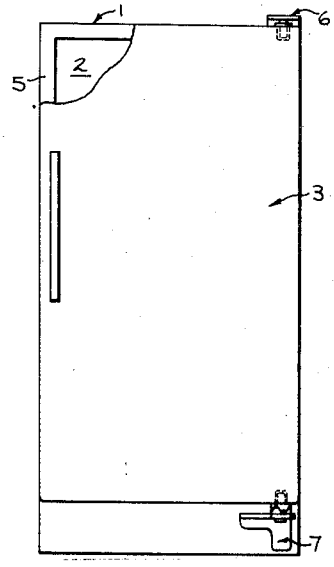
1,698,390	1/1929	Carpenter et al.	16/154
1,944,386	1/1934	Winslow	16/152
3,059,270	10/1962	Schooler	16/154
3,401,996	9/1968	Rembold et al.	312/214

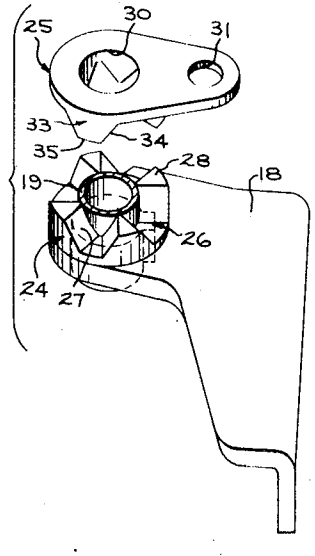
FOREIGN PATENTS

398,934	9/1933	Great Britain	16/153

Primary Examiner—James T. McCall
Attorneys—Walter E. Rule, Francis H. Boos, Jr., Frank L. Neuhauser, Oscar B. Waddell and Joseph B. Forman

ABSTRACT: A refrigerator cabinet having an access opening and a door for closing the access opening is provided with a hinge construction assuring the self closing of the door from a substantially open position and the positive sealing of the door gasket with the cabinet base as the door approaches its closed position. In accordance with the preferred embodiment of the invention, the hinge construction also includes means for positioning the door in a predetermined open position as for example at an angle of 90° with the face of the cabinet.





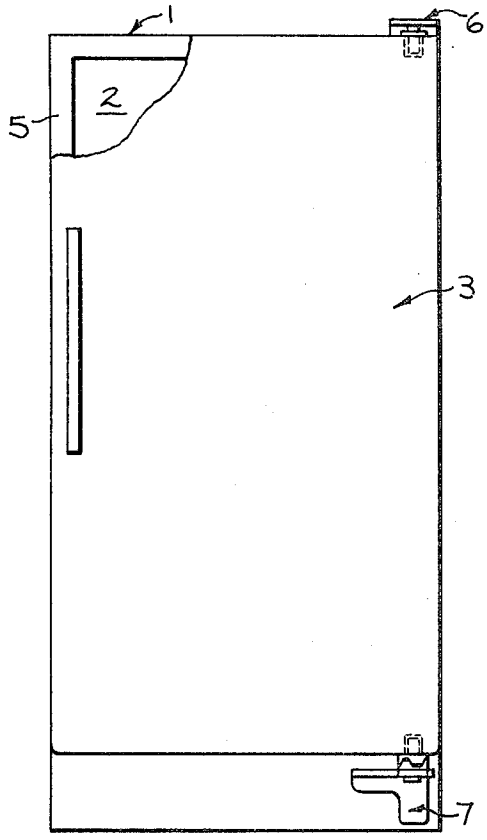


FIG. 1

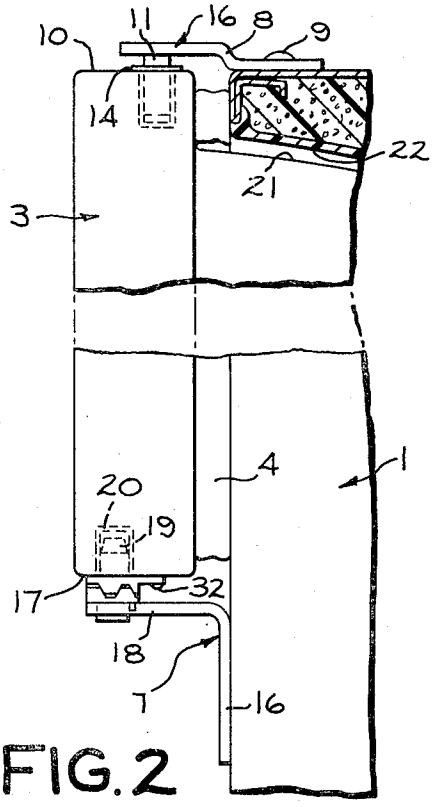


FIG. 2

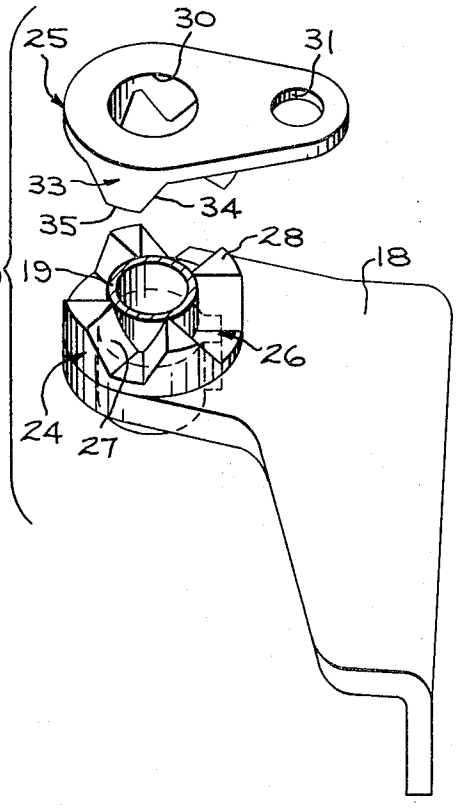


FIG. 3

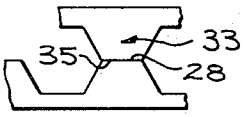


FIG. 4

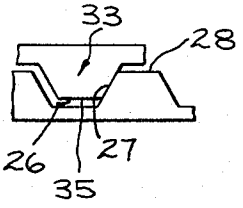


FIG. 5

INVENTOR.
BERNARD J. GRIMM
BY Walter E. Rule
HIS ATTORNEY

REFRIGERATOR CABINET WITH SELF-CLOSING DOOR

BACKGROUND OF THE INVENTION

It is of course well known that in order to maintain the desired food preservation food temperatures in a refrigerator, the door or doors closing an access opening or openings to the refrigerator should be closed and sealed. To this end it is desirable to provide means for automatically closing an open refrigerator door. However such means should not interfere with the normal usage of the refrigerator. More specifically, the closing action or movement should be relatively slow giving the user ample time in which to transfer articles to or from the storage refrigerated compartment. Also the closing force should be low so that contact of the moving door with the user's arm does not cause the user to drop an article being placed into or removed from the refrigerator.

For many years a simple and cost-free means for obtaining a slow and gentle closing of the opened refrigerator door has consisted of tilting the entire cabinet a few degrees rearwardly whereby the door when opened less than 90° will move toward its closed position by gravitational forces. Such gravitational closing of a door has also been obtained by offsetting the upper hinge axis slightly rearwardly, that is in the direction of the face of the cabinet from the lower hinge axis; this in effect resulting in a rearward tilting of the hinge axis so that a door opened less than 90° is gravity biased towards a closed position.

However, a combination of resisting forces frequently causes such a door to stop short of its completely closed position. These forces include the forces required to compress the gasket and the "piston" force resulting from a compression of the air contained within the cabinet as the door approaches its closed position. Thus the door may remain slightly ajar not enough to be noticed but sufficient to cause a loss of refrigerating temperatures.

SUMMARY OF THE INVENTION

The present invention is directed to a refrigerator cabinet including a hinge construction designed to assure the complete self-closing of the refrigerator door.

In accordance with the illustrated embodiment of the invention, there is provided a refrigerator cabinet having an access opening at the front thereof and a door for closing the access opening, the door carrying a gasket adapted to seal against the face of the cabinet surrounding the access opening. The door is supported for swinging movement on the cabinet by a hinge structure including upper and lower pivot hinges at least one of which, usually the lower hinge, provides the principle vertical support for the door. The axis of the upper hinge is offset towards the face of the cabinet from the axis of the lower hinge thereby in effect providing a tilted pivot axis for the door which is sufficient to cause the door to slowly move towards a closed position from any point short of a 90° door opening. The load-supporting hinge comprises a bearing member rigidly secured to the cabinet and surrounding the hinge pin and this member includes a plurality of spaced radially extending slots in the upper surface thereof. A plate member secured to the door and moveable therewith has a passage therein for receiving the hinge pin and also includes at least one projection thereon for engagement with one of the slots when the door is in a closed position. The slots are provided with inclined or sloping radial sidewalls adapted when a projection drops into a slot to provide a wedging action or force, the horizontal component of which urges the door towards its closed position.

In accordance with the preferred embodiment of the present invention, the load-supporting hinge also includes a slot or opposed slots adapted to receive one or more projections and thereby position the door in a predetermined partially opened position, as for example, at an angle of 90° with reference to the face of the cabinet.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing:

FIG. 1 is a front elevational view of a refrigerator incorporating the hinge structure of the present invention;

FIG. 2 is an enlarged fragmentary side view of a portion of the refrigerator of FIG. 1;

FIG. 3 is an enlarged, exploded, perspective view of the lower, vertical load-supporting hinge component of the present invention;

FIG. 4 is an enlarged fragmentary view showing the relative positions of certain elements of the lower hinge when the door is closed; and

FIG. 5 is a view similar to FIG. 4 showing the relative positions of these elements when the door is partially open.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the accompanying drawing, there is illustrated in FIGS. 1 and 2 thereof a single door refrigerator including a cabinet 1 containing a storage compartment 2 having an access opening at the front thereof closed by a door 3, the door carrying a sealing gasket 4 adapted to engage the front face 5 of the cabinet surrounding the access opening. The door 3 is mounted on the face of the cabinet 1 by means of an upper hinge 6 and a lower hinge 7 of the type which permits the door to pivot about an axis extending through the door so that as the door is moved to its open position it will not extend beyond the hinge side of the cabinet.

More specifically the upper hinge 6 comprises a bracket 8 secured to the top surface of the cabinet by means of one or more screws 9, the bracket 8 extending forwardly or beyond the face 5 of the cabinet and above the top edge 10 of the door 3. A hinge pin 11 secured to the bracket 8 extends downwardly through the top edge of the door and into a thimble 14 in the upper edge of the door 2.

Similar components of the lower hinge 7, which is the vertical load-supporting hinge, are a hinge bracket 16 suitably secured to the face of the cabinet below the lower edge 17 of the door and including a horizontal arm 18 extending forwardly below the door 3 and supporting a hinge pin 19 extending upwardly through the lower edge of the door and into a thimble 20.

As is shown in FIG. 2 of the drawing, the upper hinge pin 11 is offset rearwardly from the lower hinge pin 19 or in other words is closer to the face of the door than is the lower hinge pin 19. This offset slats the hinge axis of the door a few degrees inwardly towards the face of the cabinet and this inclination of the pivot axis of the two hinge pins gravity biases the door for movement towards its closed position from any open position of less than 90° with reference to the face of the cabinet.

The gravitational forces resulting from the offset hinge axis causes the door to move freely towards its closed position up to the point where the gasket 4 initially contacts the face of the cabinet 5. At this point closing movement of the door is opposed by initial contact of the hinge side of the gasket with the cabinet, the resistance of the gasket to compression and the piston effect of the door compressing the atmosphere within the refrigerator compartment. These opposing forces can cause the door to be stopped short of the complete gasket-sealing position. The piston effect is partly due to the fact that the inner panel or surface 21 of the usual refrigerator door, as shown in FIG. 2, extends some distance into the access opening and in overlapping relationship with the usual breaker strip 22 defining this access opening so that as soon as this part of the door enters and substantially fills the opening before the door is closed, it compresses the air within the compartment 2.

In order to assure a final or complete closing of the door, the lower or load supporting hinge structure 7 is designed to provide an additional closing force operative when the door approaches the closed position.

The means for accomplishing this result comprises a lower fixed bearing member 24 and an upper movable bearing member 25 rigidly secured to the door 3. The illustrated facing surfaces of these two bearing members are designed to assure full closing of the door, to position the door in a substan-

tial 90° open position and to provide the load supporting or bearing surfaces required to permit swinging of the door between its open and closed positions.

The lower bearing member 24 is an annular member surrounding the lower hinge pin 19. It is rigidly secured to the bracket arm 18 by any suitable means as for example by brazing it to the arm 18. Its upper or bearing surface is formed to include four equally spaced and radially extending slots 26 having sloping or inclined radial sidewalls 27, the slots 26 being separated from one another by pie-shaped flat areas 28.

The upper bearing member 25 has an opening 30 therein for receiving the hinge pin 19 and has an opening 31 therein for receiving a screw 32 for attaching the upper bearing member 25 to the lower edge of the door. Its annular bearing surface includes a plurality of outwardly extending projections 33 having inclined sidewalls 34. These projections are adapted to mate or match with the recesses 26 when the door is in either its closed or 90° position. The projections 33 also include flat lower end surfaces 35 of about the same shape and configuration as the flat surfaces 28 on the lower bearing member in order to provide maximum bearing area for supporting the weight of the door as it is moved to its open or closed positions. In the illustrated embodiment of the invention, four projections 33 are provided on the upper bearing member 25 in order to provide the maximum possible surface areas 35.

The purpose of the slanting sidewalls on the projections 19 and the mating slots 26 is to provide the additional force required to assure full gravitational closing of the door. To this end, two diametrically opposed slots and cooperating projections should be employed for closing the door. Further, in order to provide for a positioning of the door at a 90° opening point, four such slots and at least two projections are required.

In other words, the lower bearing member 24 and the upper bearing member 25 are so oriented that when the door is approaching its closed position, projections on the upper bearing member 25 will have rotated relative to the lower bearing member 24 to a position such that they drop into mating slots. The inclined sidewalls 27 of the slots and projections then provide a camming action, camming or biasing the door to its closed position.

When the door is opened, the inclined sidewalls permit the projections 33 to ride upwardly out of their mating slots. During the time that the projections 33 are between adjacent slots, the lower flat surfaces 35 are sliding over the flat bearing surfaces 28 as illustrated in FIG. 4 of the drawings. Upon a substantially 90° degree opening of the door, the resultant 90° relative rotation between the upper and lower bearing members causes the respective projections to drop into the next adjacent slots thereby positioning the door at about a 90° open position.

Preferably, and in order to more positively assure the closing and sealing of the door, the upper and lower bearing members are positioned so that when the door is completely closed, projections 19 will still be riding downwardly along the inclined sidewalls 27 of slot 26 as shown in FIG. 5 of the drawing. In other words, instead of aligning the upper and lower bearing members relative to the door and the face of the cabinet so that when the door is in its closed position, the projections are completely seated in their respective slots, these components are oriented so that complete seating would be obtained only if the door could move another few degrees, as for example, another 5°. This assures that a positive closing force is provided by the bearing members 24 and 25 even after the door is fully closed.

It will be obvious, of course, that be making varied combinations of bearing member slots and projections, the door may be located at different open positions. For example, three projections and three slots equally spaced will provide for positioning the door in a 120° open position. In general, not more than four slots and cooperating projections should be used as additional slots decrease the effective load-supporting bearing areas as represented by the flats 28 and the lower bearing member and the flat ends 35 on the upper bearing member.

While there has been shown the specific embodiment of the present invention, it is to be understood that it is not limited thereto and is intended by the appended claims to cover all such modifications as followed in the scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a refrigerator cabinet having an access opening in the front wall thereof, a door for closing said access opening and having thereon a gasket for engaging the front wall of said cabinet when the door is closed to seal said opening, and upper and lower hinge means respectively mounted on said cabinet above and below said door for pivotally supporting said door on said cabinet;

the axis of said upper hinge means being offset rearwardly from the axis of said lower hinge means;

said lower hinge means comprising a fixed bearing and a plate member;

said fixed bearing member surrounding the axis of said lower hinge means and including a plurality of spaced radially extending slots in the upper surface thereof, said slots having inclined sidewalls;

said plate member being secured to the bottom edge of said door and movable with said door and including a portion surrounding said lower hinge axis and having at least two spaced radially extending projections thereon for engagement with two of said slots when said door is in a closed position;

said projections including flat bottom surfaces adapted to ride on flat areas on said lower bearing member during pivotal movement of said door.

* * * * *