Dec. 6, 1966 R. N. CAREY 3,289,244

OFFSET HINGE ASSEMBLY FOR A SWINGABLE DOOR

Filed Dec. 7, 1964 3 Sheets-Sheet 1

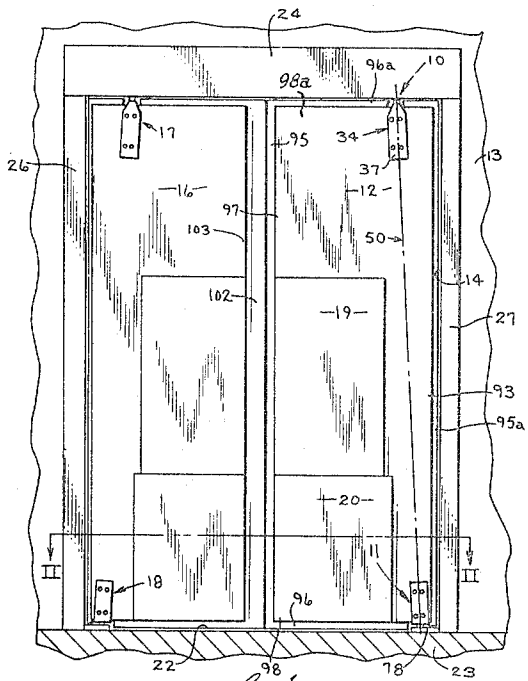


Fig. 1

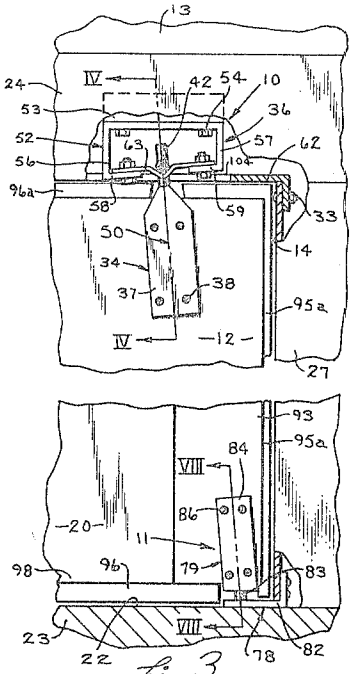


Fig. 3

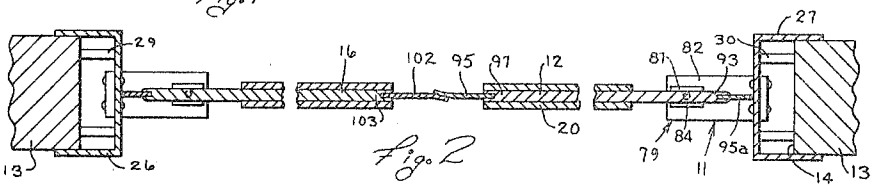


Fig. 2

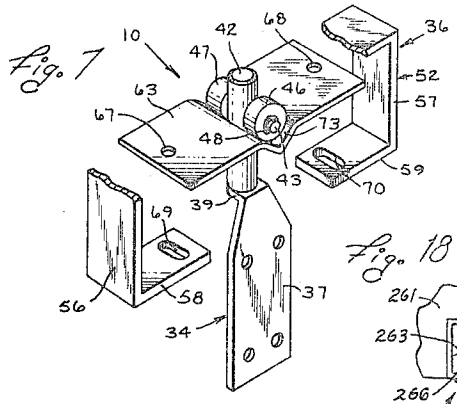


Fig. 7

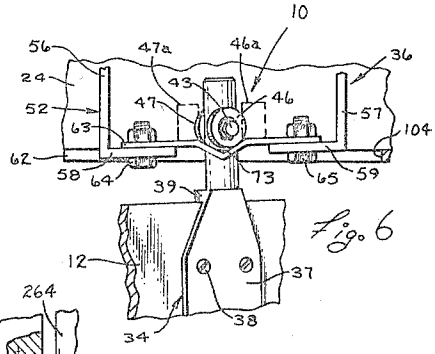


Fig. 6

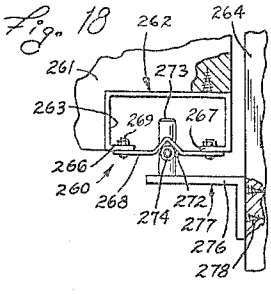


Fig. 18

INVENTOR
RUSSELL N. CAREY
BY ELIZABETH M. CAREY
EXECUTRIX
BY Woodhams, Blanchard and Flynn
ATTORNEYS

Dec. 6, 1966 R. N. CAREY 3,289,244

OFFSET HINGE ASSEMBLY FOR A SWINGABLE DOOR

Filed Dec. 7, 1964 3 Sheets-Sheet 2

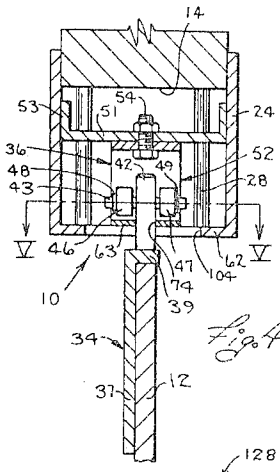


Fig. 4

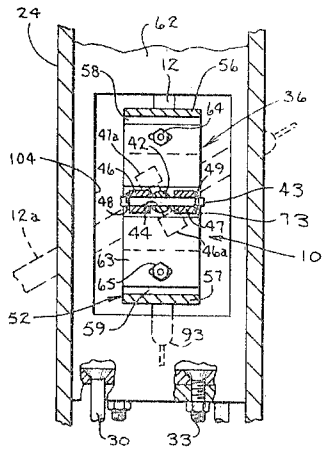


Fig. 5

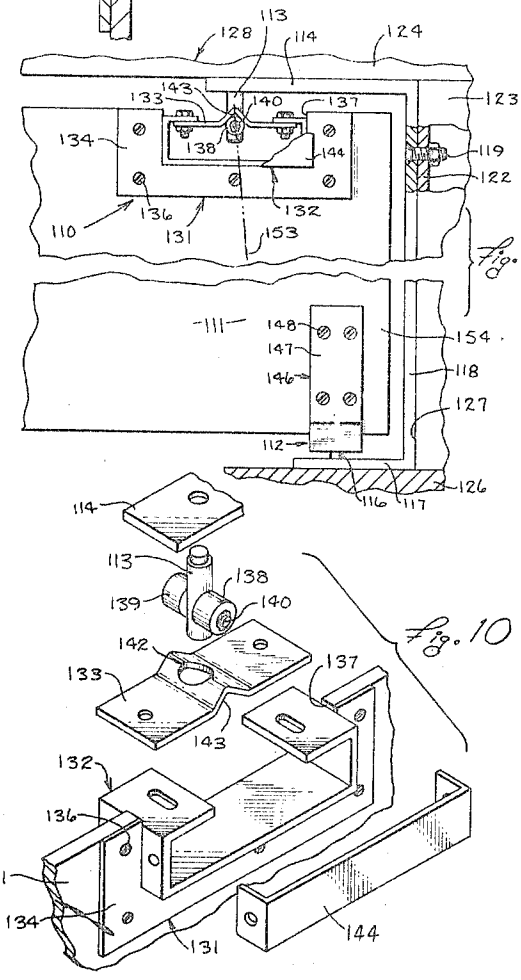


Fig. 9

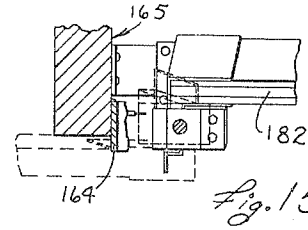


Fig. 15



Fig. 10

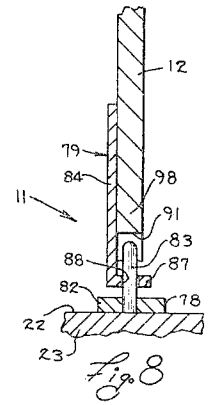


Fig. 8

INVENTOR
RUSSELL N. CAREY
BY ELIZABETH M. CAREY
EXECUTRIX
BY
Woodhams, Blanchard and Flynn
ATTORNEYS

Dec. 6, 1966 R. N. CAREY 3,289,244

OFFSET HINGE ASSEMBLY FOR A SWINGABLE DOOR

Filed Dec. 7, 1964 3 Sheets-Sheet 3

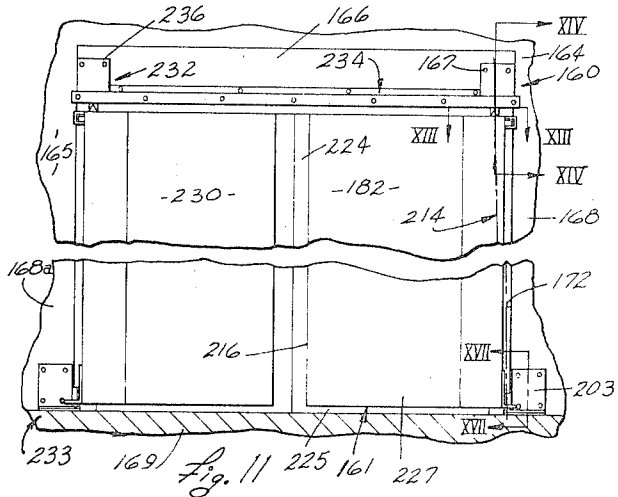



Fig. 11

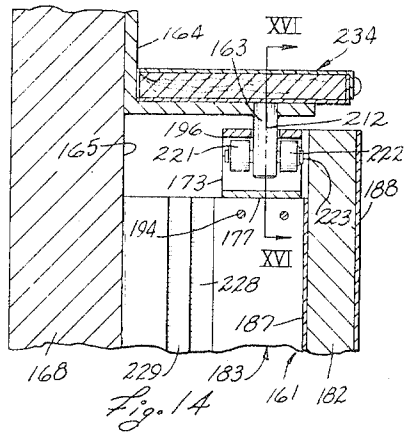



Fig. 14

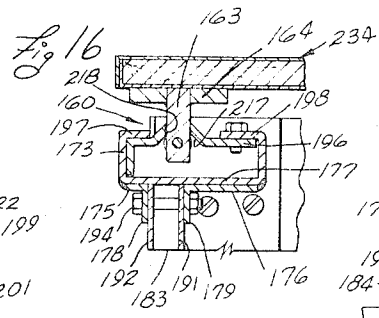



Fig 16

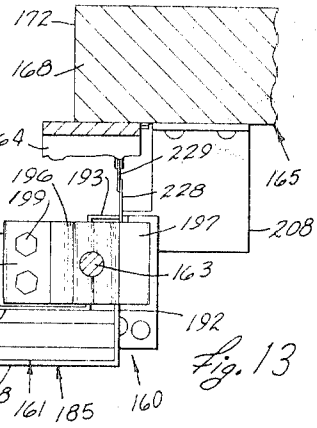



Fig. 13




Fig. 12

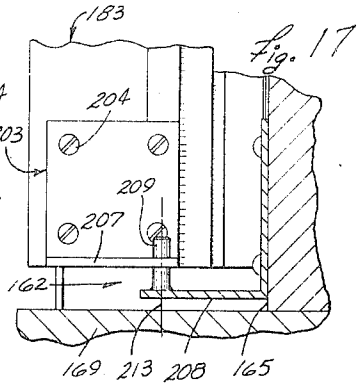



Fig. 17

INVENTOR.
RUSSELL N. CAREY
BY ELIZABETH M. CAREY
EXECUTRIX

BY Woodham, Blanchard & Flynn
ATTORNEYS

United States Patent Office

3,289,244

Patented Dec. 6, 1966



3,289,244

# OFFSET HINGE ASSEMBLY FOR A SWINGABLE DOOR

Russell N. Carey, deceased, late of Niles, Mich., by Elizabeth M. Carey, executrix, Niles, Mich., assignor to Eliason Refrigerator Company, Hartford, Mich., a corporation of Michigan

Filed Dec. 7, 1964, Ser. No. 416,651
14 Claims. (Cl. 16—154)

This application is a continuation-in-part of the application Serial No. 256,848, filed February 7, 1963, and entitled "Hinge Assembly for a Swingable Door," and now Patent No. 3,160,913 issued December 15, 1964.

This invention relates in general to a hinge construction for supporting a swingable door and, more particularly, to a type of hinge construction which mildly resists movement of the door away from a selected "at rest" position and utilizes gravity to return said door gently to said "at rest" position.

Swinging doors of the self-closing type, which include those doors referred to as gravitating doors, are well known in the art and have been used for many years. However, doors of this general character have not, insofar as I am aware, been capable of fully satisfactory operation in certain types of installations, particularly where problems of heat transfer are encountered, for the reason set forth in said application Serial No. 256,848.

Existing, self-closing doors are usually hung so that their "at rest" position is located within the opening defined by the door frame. That is, when the door is not being operated, at least most of the door is disposed between the two planes defined by the opposite surfaces of the wall containing the door opening. Thus, even when the door is fully opened, at least part of the door continues to block at least part of the opening defined by the door frame. Accordingly, the opening must be made substantially larger than the largest object which it must accommodate in order to allow for the obstruction by the door. Since this is not always possible or feasible, it is sometimes necessary to remove the doors completely from their hinges to receive such large objects through the opening.

In addition to the foregoing problem, it has been observed that most swingable doors tend to move more than 90° away from their closed position during an opening operation. This necessarily means that the hinged edge of the door may actually move into the path of or snag the object being moved through the door opening and thereby result in serious damage to the door which, in many instances, is made of relatively lightweight materials. Furthermore, where swingable doors are used to close opening between rooms having relatively large temperature differentials, the excessive opening simply increases the heat transfer problems. Thus, it will be seen that there has been a serious need for an easily swingable door, such as the door disclosed in application Serial No. 256,848, which is also capable of being moved completely out of the opening defined by the door frame when the need arises merely by effecting a completely normal, pivotal movement of the door.

Accordingly, the objects of this invention include the objects set forth in said application Serial No. 256,848 as well as the following:

(1) To provide an improved hinge construction for a swinging door of the self-closing type, which can be hung upon a wall adjacent an opening therein so that the door, when in its "at rest" position, effectively closes the opening and, when swung open in one direction, is moved completely out of a position of interference with an object being moved through the opening, which construction is relatively inexpensive to manufacture, easy to install on door panels having a wide variety of sizes and shapes, easy to mount upon a wall structure, and which is pleasing in appearance.

(2) To provide a hinge construction, as aforesaid, which permits a swinging movement of the door through the opening in both directions with the same type of gravity-actuated, pendulous and slow-moving operation characterized by the hinge structure disclosed in application Serial No. 256,848, and which permits the use of hinge elements generally similar to the hinge elements disclosed in said application Serial No. 256,848.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon reading the following descriptive material and examining the accompanying drawings in which:

FIGURE 1 is a front elevational view of a pair of swinging doors, each supported by a hinge construction of the invention upon a wall defining an opening in which the doors are located.

FIGURE 2 is a broken sectional view taken along the line II—II in FIGURE 1.

FIGURE 3 is an enlarged, broken fragment of FIGURE 1.

FIGURE 4 is a sectional view taken along the line IV—IV in FIGURE 3.

FIGURE 5 is a broken sectional view substantially as taken along the line V—V in FIGURE 4.

FIGURE 6 is an enlarged fragment of FIGURE 3 with the door in a partially open position.

FIGURE 7 is an exploded fragment of the upper hinge unit of the invention.

FIGURE 8 is a sectional view taken along the line VIII—VIII in FIGURE 3.

FIGURE 9 is a fragmentary, broken, front elevational view of a modified hinge construction embodying the invention.

FIGURE 10 is an enlarged, exploded, perspective view of the upper hinge unit of the modified hinge construction appearing in FIGURE 9.

FIGURE 11 is a broken, front elevational view of another hinge construction embodying the invention.

FIGURE 12 is an exploded, enlarged and perspective view of the hinge construction and door appearing in FIGURE 11.

FIGURE 13 is a sectional view taken along the line XIII—XIII in FIGURE 11.

FIGURE 14 is a sectional view taken along the line XIV—XIV in FIGURE 11.

FIGURE 15 is a sectional view similar to FIGURE 13 and showing the hinge and door in the open positions.

FIGURE 16 is a sectional view taken along the line XVI—XVI in FIGURE 14.

FIGURE 17 is a sectional view taken along the line XVII—XVII in FIGURE 11.

FIGURE 18 is a broken fragment of a modified upper hinge used at the lower end of a door.

For convenience in description, the terms "upper," "lower" and words of similar import will have reference to the hinge construction of the invention and a door

associated therewith as appearing in FIGURES 1, 9 and 11. The terms "inner," "outer" and words of similar import will have reference to the geometric center of said hinge construction, units thereof and parts associated therewith.

*General construction*

The objects and purposes of the invention, including those set forth above and in application Serial No. 256,848, have been met by providing an improved hinge construction for supporting a swingable door for substantially horizontal movement in either direction away from an "at rest" position into which said door is gently urged entirely by gravity. The hinge construction is comprised of an upper hinge unit, which controls the gravitating movement of the door, and a lower hinge unit which assists in guiding such movement. The hinge axis is preferably disposed at an angle to and adjacent to one vertical edge of the door, such angle diverging upwardly and being disposed either within the door opening or to one side thereof. The hingle construction of the invention can be built into the wall surrounding the opening with which it is associated, or it may be installed within the opening after the wall structure is completed.

Also, said door can be hung by an alternate form of hinge construction whereby the "at rest" position of the door is outside of the zone defined by the frame around the door opening. In such case, the hinge construction is arranged so that the door can be moved away from the door opening to prevent any obstruction thereof.

*Detailed description*

The hinge construction (FIGURES 1 and 2), which has been selected to illustrate one embodiment of the invention, is comprised of an upper hinge **10** and a lower hinge **11** which pivotally connect the upper and lower parts, respectively, of the door **12** to the adjacent portions of the wall **13** defining the opening **14** in said wall. For illustrative purposes, a second door **16** is mounted by means of the upper hinge **17** and lower hinge **18** upon the wall **13** within the opening **14** so that the doors **12** and **16** substantially completely close the opening **14** when said doors are in their "at rest" positions, as appearing in FIGURE 1. The door **16**, upper hinge **17** and lower hinge **18** are preferably, but not necessarily, identical with the door **12**, upper hinge **10** and lower hinge **11**, respectively. Accordingly, a detailed description of the door **12** and its hinges **10** and **11** will be given hereinafter and such description will be understood to apply, at least in substance, to the door **16** and its hinges **17** and **18**.

The door **12** (FIGURE 1) may be of a substantially conventional type which, in this particular embodiment, may be fabricated from a substantially rigid and durable material such as wood, plastic and/or metal. Where the door is fabricated from a lightweight, easily marred material, such as wood or aluminum, it is at least desirable to provide more durable surface panels **19** and **20** to to absorb the rough treatment given to such doors, particularly when they are opened by means other than hands. That is, swinging doors of the type for which the hinges **10** and **11** are specifically designed, are frequently opened by vehicles, containers or the like which are moved through the opening in which the door is supported. The lower panel **20**, which would normally receive the rougher treatment, may advantageously be fabricated from somewhat heavier material than the material required in the upper panel **19**. The added weight in said lower panel **20** also facilitates the closing movement of the door as discussed hereinafter.

The opening **14** in the wall **13** is defined by a threshold **22** on the floor **23**, a head jamb **24** and a pair of side jambs **26** and **27** which extend between said threshold **22** and said head jamb **24**. In this particular embodiment, the head jamb **24** and side jambs **26** and **27** are disclosed as channel-shaped members which slideably embrace adjacent portions of the wall **13**. The head jamb **24** (FIGURE 4) is held in place by means such as bolts **28**, and said side jambs **26** and **27** are held in place by means such as the bolts or screws **29** and **30**, respectively (FIGURE 2). The head jamb **24** and side jambs **26** and **27** (FIGURES 3 and 5) may be rigidly connected to each other near their adjacent ends by means such as the bolts **33**.



The upper hinge **10** includes a pivot member **34** (FIGURES 3, 6 and 7), which is connected to the upper end of the door **12**, and a support member **36** which is secured to and within the head jamb **24**. More specifically, pivot member **34** (FIGURE 3) includes a mounting plate **37**, which is rigidly secured to the door **12** by screws **38**. The mounting plate **37** (FIGURES 4 and 7) has an integral, sidewardly extending flange **39** at its upper end to which an upwardly extending pivot pin **42** is rigidly secured, as by welding. The pivot axis **50** (FIGURE 1) of the pivot pin **42** is preferably parallel with the lengthwise extent of the mounting plate **37**.

A roller shaft **43** (FIGURE 5) extends through and is snugly held within a diametrical opening **44** through the pivot pin **42**, preferably so that said shaft **43** is perpendicular to the plane defined by the mounting plate **37**. A pair of rollers **46** and **47** are rotatably supported upon the shaft **43** on opposite sides of the pivot pin **42** and are held upon said shaft **43** by means such as the spring clips **48** and **49**. The rollers **46** and **47** are preferably identical in size and shape and are also preferably fabricated from a durable, self-lubricating material, such as nylon, Teflon or the like. However, said rollers **46** and **47** could also be made of hardened steel, or they could be roller or ball bearings.

The pivot member **34** (FIGURE 3) is preferably mounted upon the door **12** so that the axis **50** of the pivot pin **42** is inclined with respect to the adjacent side jamb **27** at an angle of approximately 3°, when the door **12** is in its "at rest" position within the opening **14**, which position is substantially parallel with the wall **13**. In said "at rest" position, the roller shaft **43** is substantially perpendicular to said wall **13**.

The support member **36** includes an elongated support bracket **52** which is mounted within the head jamb **24** (FIGURE 4) upon the web **51** of the channel member **53** by the bolts **54**. Said channel member **53** may be welded to the head jamb **24**. Said support bracket **52** has at its opposite ends a pair of integral, downwardly extending hangers **56** and **577** with integral flanges **58** and **59**, respectively, which extend toward each other substantially within the same plane from the lower ends of said hangers. The plane defined by said flanges **58** and **59** is preferably disposed at an angle of approximately 3° to the horizontal, or to the web **62** of the head jamb **24** (FIGURES 3 and 6) so that said plane is substantially perpendicular to the axis **50** of the pivot pin **42**.

An elongated substantially rectangular support plate **63** (FIGURES 5 and 7) is mounted upon and between the flanges **58** and **59** as by the bolts **64** and **65** which extend through openings **67** and **68** in the plate **63** and openings **69** and **70** in the flanges **58** and **59** respectively. The openings **69** and **70** in the flanges **58** and **59** are preferably elongated laterally of the bracket **52** to permit lateral adjustment of the support plate **63** with respect to the support bracket **52** when the door **12** is initially hung or later aligned within the opening **14**.

The support plate **63** has a tranverse upwardly opening groove **73** which is substantially V-shaped in cross section and into which the rollers **46** and **47** are simultaneously receivable. Said support plate **63** also has a central opening **74** which preferably extends through the center of the groove **73**. Said opening **74** is slightly larger than the diameter of the pivot pin **42** and said opening is located so that the pivot pin **42** does not engage the edge of the opening **74**, particularly in a direction crosswise of said groove **73**, when the rollers **46** and **47** are snugly disposed within the groove **73**. Accordingly, the rollers **46** and **47** will always return to their fully seated posi-

tions within the groove **73** when the door is released to swing freely. The groove **73** is preferably narrow, in this particular embodiment, so that the door must be at an angle of preferably less than 45° to the "at rest" position before the rollers start to move downwardly into the groove **73**. Thus, the door **12** can be swung substantially beyond its "at rest" position, as indicated by broken lines at **12***a* in FIGURE 5, without being held open by said groove and rollers. On the other hand, by widening the groove **73**, as shown in FIGURE 5, it is possible to use said groove not only to hold the door **12** in its "at rest" or closed position, but also to hold it in an open position substantially beyond a 90° angle from its closed position.

The lower hinge **11** (FIGURES 3 and 8) includes a pivot member **78**, which is mounted upon the lower end of the side jamb **27** adjacent the threshold **22** of the opening **14**, and a guide member **79**, which is rigidly secured to the lower end of the door **12**. The pivot member **78** includes a support plate **82** which is rigidly secured near one end to the side jamb **27** and which has near its other end an upstanding pivot pin **83**, which pin is preferably coaxial with the pivot pin **42**, when the door **12** is in its FIGURE 1 position. The guide member **79** has a mounting plate **84**, which is rigidly secured to the lower end of the door **12** by screws **86**, and it has an integral sidewardly extending flange **87** at its lower end which extends under the door **12**. The flange **87** has a pivot opening **88** through which the pivot pin **83** is slideably and rotatably receivable. The lower end of the door **12** may be recessed at **91** to loosely receive the upper end of the pivot pin **83**.

The lower hinge **11** (FIGURE 8) is intentionally constructed so that it does not support any of the weight of the door **12**, since that would interfere with the gravitating action effected by the upper hinge **10**. Although the common axis **50** (FIGURE 1) of the pivot pins **42** and **83** (FIGURE 3) is preferably disposed at an angle of approximately 3° with respect to the adjacent edge **93** of the door **12**, hence the adjacent vertical surface of the side jamb **27**, other angles of inclination can be used if desired or required. For example, the inclination will effect the movement of the door from its open to its closed position and the amount of force required to move the door from its closed to its open position.

The door **12**, where used to close an entry to a cold storage room, may be provided with gaskets or sealing elements **95**, **95***a* and **96**, **96***a* along its vertical edges **97** and **93** and its horizontal edges **98** and **98***a*, respectively. The seals **95**, **95***a*, **96** and **96***a* are preferably fabricated from resiliently flexible material, such as re-enforced rubber or plastic material, which is capable of repeated bending and rubbing with a minimum of set and/or wear. The bottom seal **96** is arranged so that it is closely adjacent the floor **23** when the door **12** is in its "at rest" position of FIGURE 1. The vertical seal **95** is arranged so that it extends slightly beyond the midway line between the adjacent edges **97** and **103** of said doors **12** and **16**, respectively, when they are both in their "at rest" positions of FIGURES 1 and 2. Thus, the seal **95** will overlap and gently engage the corresponding seal **102** on the vertical edge **103** of the main panel of the door **16** when it is mounted by its hinges **17** and **18** within the opening **14**, as described above with respect to the door **12** and its hinges **10** and **11**.

The vertical seal **95***a* is secured to and extends from the edge **93** of the door **12** so that said seal slightly engages the adjacent surface of the side jamb **27** when said door is in its "at rest" position. The top seal **96***a* (FIGURE 1), which is secured to the upper edge of the door **12**, may be spaced downwardly slightly from the head jamb **24** when said door **12** is in its "at rest" position in FIGURE 1. Thus, when the door is raised slightly, as it is swung away from said "at rest" position, due to the action between the rollers **46**, **47** and the support plate **63**, said top seal **96***a* will not be jammed against the head jamb **24**.



*Operation*

As indicated above, the doors **12** and **16** (FIGURES 1 and 2) are disposed in their "at rest" positions when their meeting edge seals **95** and **102**, respectively, are in slightly overlapped engagement substantially throughout their lengths. As shown with respect to the door **12**, the "at rest" position is achieved and maintained by the snug reception of the rollers **46** and **47** within the groove **73** in the support plate **63** (FIGURE 7). When the door **12** is moved around the pivot axis **50** (FIGURE 1) in one direction or the other (FIGURE 6) away from the "at rest" position, the rollers **46** and **47** are caused to climb up the side walls of the groove **73**, thereby raising the door **12** slightly due to a camming action. The walls of the groove **73** are preferably relatively steep so that the rollers promptly move up on to the upper surface of the support plate **63** into their raised positions, which are indicated in broken lines at **46***a* and **47***a* in FIGURE 6. This upward movement serves the purpose of moving the bottom seal **96** away from the floor **23** with a minimum of dragging action therebetween. The groove **73** is preferably designed so that the rollers **46** and **47** do not move back into the groove **73** until the door **12** is at an angle of less than 45° to its "at rest" or its closed position. Thus, the door **12** can be moved easily into the open position, indicated by broken lines at **12***a* in FIGURE 5, and it can still return by gravity to its "at rest" position.

If the door **12** is unobstructed when it has reached its open position **12***a* (FIGURE 5), gravity will move the door **12** back toward its "at rest" position due to the inclination in the pivot axis **50** of the door hinges **10** and **11** and the cooperating, inclined upper surface of the support plate **63**. This movement is largely pendulous in nature and is not intended to be a camming action. Camming occurs only after the rollers reach the groove **73** and start to move downwardly thereinto, whereby closing movement of the door tends to be accelerated slightly. However, when the rollers pass their "at rest" positions in the groove **73** continued movement of the door requires a raising thereof which immediately retards such movement. The resultant oscillation of the door **12** is quickly stopped with Applicant's invention, unless the groove **73** is relatively shallow.

Because the rollers **46** and **47** (FIGURES 4 and 5) are disposed on opposite sides of the pivot pin **42**, extremely accurate positioning of the "at rest" position of the door **12** can be achieved. That is, with said rollers in the groove **73**, the bolts **64** and **65** are loosened so that the support plate **63** can be adjusted with respect to the flanges **58** and **59**. When adjustment of the door **12** is exactly as desired, the bolts **64** and **65** are tightened. The protection panels **19** and **20** tend to shift the center of gravity of the door **12** toward the meeting edge **97** thereof, which improves the closing operation of the door, particularly on lightweight doors.

The door **12**, and in a similar manner the door **16**, can be quickly and easily removed for inspection and/or repair merely by removing the bolts **64** and **65** and thereafter sliding the support plate **63** sidewardly and downwardly through the opening **104** in the web **62** of the head jamb **24**. Thereafter, the door **12** may be tilted and then raised so that the guide member **79** is moved away from and off the pivot pin **83**. Alternatively, and where expedience dictates, the door **12** can be removed from its opening **14** by loosening the screws **38** which secure the mounting plate **37** to said door **12** after which the door is raised until the guide member **79** is released from engagement with the pivot member **78**. Obviously, the door **12** can be quickly returned to its operating position by reversing the foregoing steps.

*Modified construction*

The modified hinge construction disclosed in FIGURES 9 and 10 includes an upper hinge **110**, which is connected

to the upper end of the door 111, and a lower hinge 112 which is connected to the lower end of the door 111. The upper hinge 110 includes a substantially vertical hinge pin 113 which is secured at its upper end to the upper pin plate 114, The lower hinge 112 includes a lower hinge pin 116 which is secured to the lower pin plate 117. The upper and lower pin plates 114 and 117 are integral with and extended sidewardly in the same direction from the opposite ends of the jamb plate 118, which is secured by means such as the bolts 119 to the web 122 of the channel-shaped side jamb 123. The pin plates 114 and 117 are held snugly against the head jamb 124 and 126, respectively, which combine with the side jamb 123 to define a door opening 127 in the wall 128.

The upper hinge 110 includes a support member 131 having a support bracket 132 and support plate 133 which in general may be similar to the support bracket 52 and support plate 63 (FIGURE 3), except that their positions are reversed and inverted. A mounting plate 134 is secured to the support bracket 132 for the purpose of connecting the support member 131 by means of the screws 136 to the door 111. The upper edge of the door 111 is provided with a notch 137 into which the support bracket 132 is snugly received when said connection is accomplished.

Rollers 138 and 139, which may be similar to the rollers 46 and 47, are rotatably supported upon a shaft 140 which is in turn secured to the upper hinge pin 113 in substantially the same manner as the shaft 43 is mounted upon the pivot pin 42. The support plate 133 has a central opening 142 for loose reception of the pin 113 therethrough. Said plate 133 also has a downwardly facing groove 143 which extends through the opening 142 and is engaged by the rollers 138 and 139, as discussed above with respect to the upper hinge 10, except that the corresponding elements are in the reverse positions. That is, when the door 111 is swung away from its "at rest" position of FIGURE 9, the support plate 133 moves with the door and with respect to the hinge pin 113 so that the lower surface of the support plate 133 moves upwardly onto the rollers 138 and 139, whereby the door 111 is raised slightly. A typical cover plate 144 (FIGURES 9 and 10) is mounted upon the support bracket 132 and extends across the front surface of the parts disposed therein. A similar cover plate can be mounted upon the opposite side of the support bracket 132.

The lower hinge 112 includes a guide member 146 having a mounting plate 147 which is secured by the screws 148 to the lower portion of the door 111.

The vertical jamb plate 118 is somewhat further from the upper hinge pin 113 than it is from the lower hinge pin 116 so that the hinge axis 153 diverges upwardly with respect to the adjacent edge 154 of the door 111. Thus, when the door 111 is moved in a substantially horizontal direction either way from its "at rest" position of FIGURE 9, gravity urges the return of the door toward its "at rest" position. The reception of the rollers 138 and 139 into the groove 143 dampens the oscillations of the door as it swings back with a pendulous motion toward its "at rest" position and positively locates such "at rest" position.

By a minor obvious modification of the support member 131, the support bracket 132 thereof can be fabricated like the support bracket 52 (FIGURE 3) so that the support plate 133 is held in a position substantially perpendicular to the hinge axis 153 (FIGURE 9). Under such circumstances, particularly where a relatively light door is involved, it might be advantageous to tilt the hinge pins 113 and 116 so that they are coaxial with the hinge axis 153, as in the case of the hinge construction disclosed in FIGURE 3. It will be seen that the hinge construction in FIGURE 9 can be mounted to support an existing door in an existing door jamb without any material modification in either part except for the notch in the upper edge of the door 111.

The upper hinge 110 (FIGURE 9) and the upper hinge 10 (FIGURE 3) require no lubrication due to the material used in the rollers 138, 139 and 46, 47, respectively. Lubrication of the lower hinges 112 and 11, should the need become apparent, can be eliminated by providing a nylon bearing in the guide member 146 around the hinge pin 116.

The alternate hinge construction, which is disclosed in FIGURES 12 and 13 is adapted to support partition doors outside of the door opening so that the entire opening can be unobstructed. This construction includes an upper hinge 160 (FIGURES 13, 14 and 16), which is connected to the upper end of the door 161, and a lower hinge 162 (FIGURES 12 and 17), which is connected to the lower end of said door 161. Broadly speaking, the upper and lower hinges 160 and 162 are similar in construction and operation to the upper and lower hinges 110 and 112, respectively, which are shown in FIGURE 9.

More specifically, the upper hinge 160 (FIGURES 12 and 16) includes an L-shaped, upper pin bracket 164 which supports a downwardly extending hinge pin 163 and which is mounted upon the surface of the wall 165 near one end of the upper jamb 166 by screws 167. The upper jamb 166 (FIGURE 11), side jambs 168 and 168*a* and threshold 169 combine to define a door opening 172 adjacent to which the door 161 is swingably supported in an "at rest" position by the hinges 160 and 162 preferably for movement through an angle of at least 90° in either direction away from said "at rest" position. The upper hinge 160 also includes a U-shaped support bracket 173 which may be substantially identical to the support bracket 132 shown in FIGURE 10. A pair of L-shaped brackets 175 and 176 (FIGURES 12 and 16) are rigidly secured, as by welding, to the lower surface of the web 177 of the U-shaped support bracket 173 so that the spaced, parallel flanges 178 and 179 of said brackets 175 and 176 extend downwardly from said web.

The door 161 (FIGURE 12), in this particular embodiment, includes a substantially planar, main panel 182 and a sidewardly extending end wall 183. As shown in FIGURES 12 and 13, the wall 183 is comprised of a pair of L-shaped, elongated angle members 184 and 185 whose flanges 187 and 188 are tightly held against the inner and outer surfaces, respectively, of the main panel 182 adjacent one edge thereof. The flanges 191 and 192 of the members 184 and 185 are interconnected by a web 193 integral with the corresponding edges thereof. The flanges 191 and 192 are preferably substantially perpendicular to the plane of the main panel 182 and project therefrom a distance preferably somewhat greater than the width of the U-shaped bracket 173.

The upper ends of the flanges 191 and 192 are snugly disposed between and against the inner opposing surfaces of the flanges 178 and 179 on the brackets 175 and 176, to which they are secured, as by means of screws 194.

The upper hinge 160 also includes an elongated support plate 196 which may be in general similar to the support plate 133 (FIGURE 10). The opposite ends of the support plate 196 are preferably disposed beneath the inwardly extending flanges 197 and 198 on the U-shaped support bracket 173 where they are held by any suitable means, such as screws 199, which are received through the openings 201 and 202 in the support plate 196 and flange 198, respectively.

The lower hinge 162 (FIGURE 12) is comprised of an L-shaped guide plate 203 which is secured, as by screws 204, to the flange 191 near the lower end thereof and which has a pin opening 206 through its horizontal flange 207. A substantially L-shaped pin supporting bracket 208, upon which the upstanding pin 209 is rigidly secured, may be mounted upon the adjacent surface of said wall 165 so that said pin 209 is received through the pin opening 206 in the horizontal flange 207. As shown in FIGURES 14 and 17, the axes 212 and 213 of the pins 163 and 209, respectively, are arranged so that the pivotal axis 214 (FIGURE 11) of the door 161 tilts toward the

meeting edge **216** of the main panel **182**. Accordingly, pivotal movement of the door **161** away from its "at rest" position of FIGURE 11 toward either the solid line or broken line position shown in FIGURE 15, will cause said door to swing slightly upwardly around the pivotal axis **214**.

The support plate **196** (FIGURE 12) has a downwardly opening, transverse and substantially V-shaped groove **217** with a central opening **218** therein through which the pin **163** extends. A pair of rollers **221** and **222** are rotatably supported upon an axle **223** which extends through and is supported upon the upper hinge pin **163** in substantially the same manner and for substantially the same purpose as discussed above with respect to the rollers **46** and **47** (FIGURE 4).

During the initial pivotal movement of the door **161** away from its "at rest" position in either direction, the relative movement of the rollers **221** and **222** out of the groove **217** will effect a camming action whereby the door **161** is lifted a distance about equal to the depth of the groove.

Gasket strips **224** and **225** (FIGURE 12) may be mounted upon the meeting edge **216** and bottom edge **227**, respectively, of the main panel **182**, particularly where the door is intended for use between rooms having substantial differential temperatures. Likewise, a gasket strip **228** may be mounted upon the outer surface of the end wall **183**, for example, so that it projects inwardly therefrom for engagement with a gasket strip **229** (FIGURE 13) which is mounted upon the adjacent surface of the wall **165** when the door **161** is in its "at rest" position.

Another door **230** (FIGURE 11), which is preferably a mirror image of the door **161**, may be mounted within the door opening **172** for cooperation with the door **161** in a manner similar to that discussed above with respect to the doors **12** and **16** (FIGURE 1). The door **230** is supported by an upper hinge **232**, which may be identical with the upper hinge **160**, and a hinge **233**, which may be a mirror image of the lower hinge **162**. These hinges may be assembled in a manner substantially as set forth above with respect to the upper hinge **160** and lower hinge **162**. Practically all of the parts of the hinges **160** and **1962**, except for the pin bracket **208**, can be made interchangeable between a lefthand door and a righthand door, so that they can be used to produce a door **231**.

A substantially flat canopy **234** may be mounted upon the horizontal flanges of the two L-shaped support brackets **173** and **236** of the upper hinges **160** and **232**, respectively, as appearing in FIGURE 11. Thus, the canopy completes the closure structure including the doors **161** and **231**.

The general operation of the doors **161** and **231** may be substantially as set forth above with respect to the operation of the doors **12** and **16**, for example. That is, if a force is applied to the door **161**, for example, when it is in the "at rest" position and in either direction away from said "at rest" position, which force is slightly greater than enough to overcome the slight, initial resistance produced by the camming action between the rollers **221** and **222** and the groove **217**, said force will cause the door to swing into a substantially completely open position with a relatively slow movement. The return movement of the door into the closed position will also be slow. The pivot axis **214** is arranged so that when the door **161** is moved so that it swings through the opening **172**, the panel **182** will move against the side jamb **168** and thereby provide a minimum of obstruction to the opening. However, when the door **161** is swung in the opposite direction, or away from the door opening **172**, it can assume an open position, as shown in solid lines in FIGURE 15, wherein the opening **172** is completely unobstructed by said door.

As shown in FIGURE 18, a hinge **260** which somewhat resembles the hinge **110** (FIGURE 9) may be mounted upon the lower portion of a door **261** to effect substantially the same purposes achieved by mounting



said hinge **110** at the top of the door **111**. More specifically, the hinge **260** includes a support bracket **262** which is substantially rectangular in shape and is received into a notch **263** in the lower corner of the door **261** adjacent the side jamb **264**. Said bracket **262** includes a pair of substantially parallel flanges **266** and **267** which are spaced from but extend toward each other, preferably substantially adjacent the lower edge of the door **261**. A support plate **268**, which may be substantially identical with the support plate **63** (FIGURE 3), has its opposite ends disposed beneath and held against the flanges **266** and **267** by means such as the bolts and nuts **269**.

Said support plate **268** (FIGURE 18) has a downwardly facing, transverse groove **272** into which the rollers, which are mounted on opposite sides of the pivot pin **273**, are receivable. One of these rollers is shown at **274** in FIGURE 18. Said pivot pin **273** extends through an appropriate opening through the groove **272** in substantially the same manner as discussed above with respect to the hinge **110** (FIGURE 9). However, said pivot pin **273** is, in this particular embodiment, supported at its lower end upon the horizontal flange **276** of the L-shaped bracket **277**, the other flange of which is secured to side jamb **264** by screws **278**.

The operation of hinge **260** is, in general, similar to the operation of the hinge **110**. Moreover, said hinge **260** can be made so that the support plate **268** is sloped downwardly away from the side jamb **264** to better accommodate same to a hinge axis which diverges upwardly with respect to the side jamb **264**, in a manner previously discussed in detail.

It will be recognized by reference to the several modifications of the hinge constructions disclosed in this application and in said application Serial No. 256,848, that the desired results can be affected with hinge constructions which differ from the specific upper and lower hinge assemblies described herein.

Accordingly, although particular preferred embodiments of the invention have been disclosed for illustrative purposes, it will be understood that variations or modifications of such disclosure, which come within the scope of the appended claims, are fully contemplated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

**1**. A hinge structure for supporting a door adjacent an opening in a wall structure for movement around a hinge axis substantially parallel with the plane of said door, said axis being at a small acute angle to the vertical centerline of the door, comprising:

a support mechanism connected between adjacent edge portions of said door and said wall structure adjacent said opening, said support mechanism comprising pin means substantially parallel and substantially concentric with said axis, said axis being offset sidewardly from said door, a pair of support elements mounted upon substantially opposite sides of said pin means, and a support plate substantially perpendicular to said pin means, said plate having a pin opening through which said pin means extends and substantially V-shaped recess means into which said support elements are substantially simultaneously receivable on substantially opposite sides of said pin opening, whereby said door is substantially supported by said support mechanism for pivotal movement around said axis, said door being urged by gravity into a position wherein it obstructs said opening and both support elements are disposed in said recess means and thereby oppose pivotal movement of said door; and

guide means connected between other adjacent edge portions of said door and said wall structure adjacent said opening and spaced substantially from said support mechanism, said guide means being located along said axis to guide the pivotal movement of said other adjacent portion of said door, whereby said

door can be pivoted from said first-mentioned position into a second position wherein said opening is unobstructed by said door.

2. A hinge structure according to claim 1 wherein the lengthwise axis of said pin means is parallel with the vertical centerline of the door and, accordingly, at a small acute angle to said hinge axis; and

wherein said support plate is perpendicular to said lengthwise axis of said pin means and, accordingly, at a large acute angle to said hinge axis.

3. A hinge structure according to claim 1 wherein said pin means is secured to said wall structure and the lengthwise axis of said pin means is parallel with the vertical centerline of the door and, accordingly, is at a small acute angle to said hinge axis; and

wherein said support plate is secured to said door and is perpendicular to said pin means, said recess means opening downwardly.

4. A hinge structure according to claim 1 wherein said guide means includes a guide pin secured to said wall structure near the lower end of said door and extending upwardly parallel with the vertical centerline of the door, and a guide member on said door defining an opening into which said guide pin is loosely and slideably received.

5. A hinge structure according to claim 1 wherein said guide means is located near the top of said door and the support mechanism is located near the bottom of said door, said pin means being mounted upon said wall structure and said support plate being mounted upon said door so that the lengthwise axis of said pin means is parallel with the vertical centerline of the door, perpendicular to said support plate and at a small acute angle to the hinge axis, said recess means opening downwardly.

6. A hinge structure according to claim 1 wherein said pin means is mounted upon said wall structure, said support plate is mounted upon said door and said recess means opens downwardly; and

including canopy means mounted upon said wall structure and covering a substantial portion of said support mechanism.

7. A hinge structure according to claim 1 wherein said support elements comprise a pair of rollers and shaft means extending from opposite sides of said pin means and supporting said rollers for rotation around substantially horizontal axes substantially perpendicular to said plane of said door when said door is in said first-mentioned position.

8. The structure of claim 1 wherein said pin means and part of said guide means are rigidly secured to said door near one upright edge thereof;

wherein said support plate and another part of said guide means are secured to said wall structure; and

wherein said recess means opens upwardly.

9. The structure of claim 1 wherein said pin means is rigidly secured to said wall structure;

wherein said support plate and part of said guide means are rigidly secured to said door; and

wherein said recess means opens downwardly.

10. A hinge structure for supporting a door upon a wall structure adjacent to and on one side of an opening therein for movement around a hinge axis substantially parallel with said door, said axis being near one upright edge of said door and diverging upwardly at a relatively small, acute angle to a vertical line adjacent said edge of said door, comprising:

pivot pin means rigidly secured to said wall structure near the upper edge of said opening and near a substantially vertical edge of said opening, said pivot pin means extending downwardly substantially vertically;

a pair of similar rollers and means supporting same upon substantially opposite sides of the pivot pin means for rotation around substantially horizontal axes substantially perpendicular to said wall structure;

a mounting plate secured to the door adjacent an upper edge portion thereof and near said upright edge thereof, said mounting plate being substantially perpendicular to said pivot pin means and having a central opening through which said pivot pin means is loosely received and having a downwardly opening, substantially V-shaped groove extending across said opening and substantially perpendicularly to the plane of said door, said rollers being disposed within said groove when the door is in a position substantially parallel with said wall structure and spaced laterally therefrom; and

lower pivot means connected between the lower edge portion of said door and said wall structure to guide the movement of said door around said hinge axis, the hinge axis extending through said pivot pin means and said pivot means, whereby said door is pivotally supported for substantially horizontal movement in both directions away from said position, wherein said door is urged by gravity.

11. A hinge structure according to claim 10 wherein the axes of said pivot pin means and said lower pivot means are parallel and spaced transversely from each other so that they are both at a small acute angle to said hinge axis, whereby movement of said door away from said position within said plane causes said door to be supported primarily by engagement of one of said rollers with said support plate.

12. A hinge structure according to claim 10, wherein said door is L-shaped transversely of said upright edge thereof to provide a relatively large closure panel which is disposed within said position when said rollers are within said groove, and a relatively short edge panel substantially perpendicular to said closure panel adjacent said upright edge, said mounting plate being secured to the upper end of said edge panel, and said lower pivot means being connected to the lower end of said edge panel, said edge panel being disposed between said closure panel and said wall structure when said door is in said position.

13. A hinge structure for supporting a door having panel means adjacent an opening in a wall structure for movement around a hinge axis substantially parallel with the plane of said door, said axis being at a small acute angle to the vertical centerline of the door, comprising:

a support mechanism connected between adjacent edge portions of said door and said wall structure adjacent said opening, said support mechanism comprising pin means substantially parallel and substantially concentric with said axis, said axis being offset sidewardly from said panel means, support means mounted upon said pin means, and a support plate substantially perpendicular to said pin means, said plate having a pin opening through which said pin means extends and substantially V-shaped recess means into which said support means is receivable near said pin opening, whereby said door is substantially supported by said support mechanism for pivotal movement around said axis, said door being urged by gravity into a position wherein it obstructs said opening and said support means is disposed in said recess means and thereby opposes pivotal movement of said door; and

guide means connected between other adjacent edge portions of said door and said wall structure adjacent said opening and spaced substantially from said support mechanism, said guide means being located along said axis to guide the pivotal movement of said other adjacent portion of said door, whereby said door can be pivoted from said first-mentioned position into a second position wherein said opening is unobstructed by said door.

14. A hinge structure according to claim 13, wherein the lengthwise axis of said pin means is upright, parallel with the vertical centerline of the door and at a small acute angle to said hinge axis; and

wherein said support plate is perpendicular to said

lengthwise axis of said pin means and at a large acute angle to said hinge axis.


**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,563,154 | 11/1925 | Brager et al. | 20—16.3 |
| 1,787,468 | 1/1931 | Bittorf et al. | 16—103 |
| 2,220,335 | 11/1940 | Hubbs | 16—154 X |





| | | | |
|---|---|---|---|
| 2,351,800 | 6/1944 | Baum et al. | 16—154 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 19,165 | 9/1899 | Great Britain. |



EDWARD C. ALLEN, *Primary Examiner.*

JOSEPH D. SEERS, *Examiner.*

D. GRIFFIN, *Assistant Examiner.*