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L. G. HOPKINS
DOOR MOUNTING

3,030,656

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3 Sheets-Sheet 1

FIG. 1.

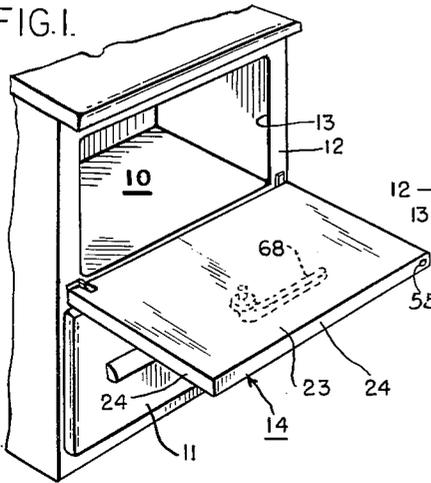


FIG. 2.

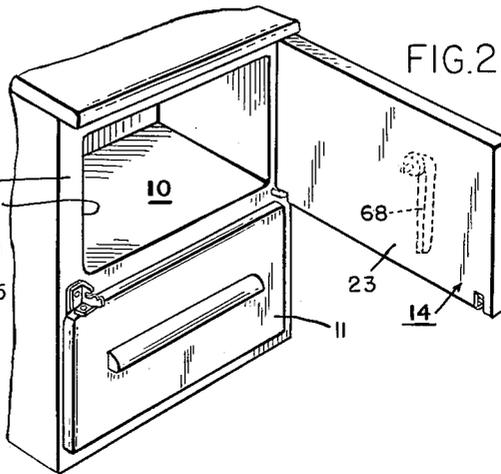


FIG. 3.

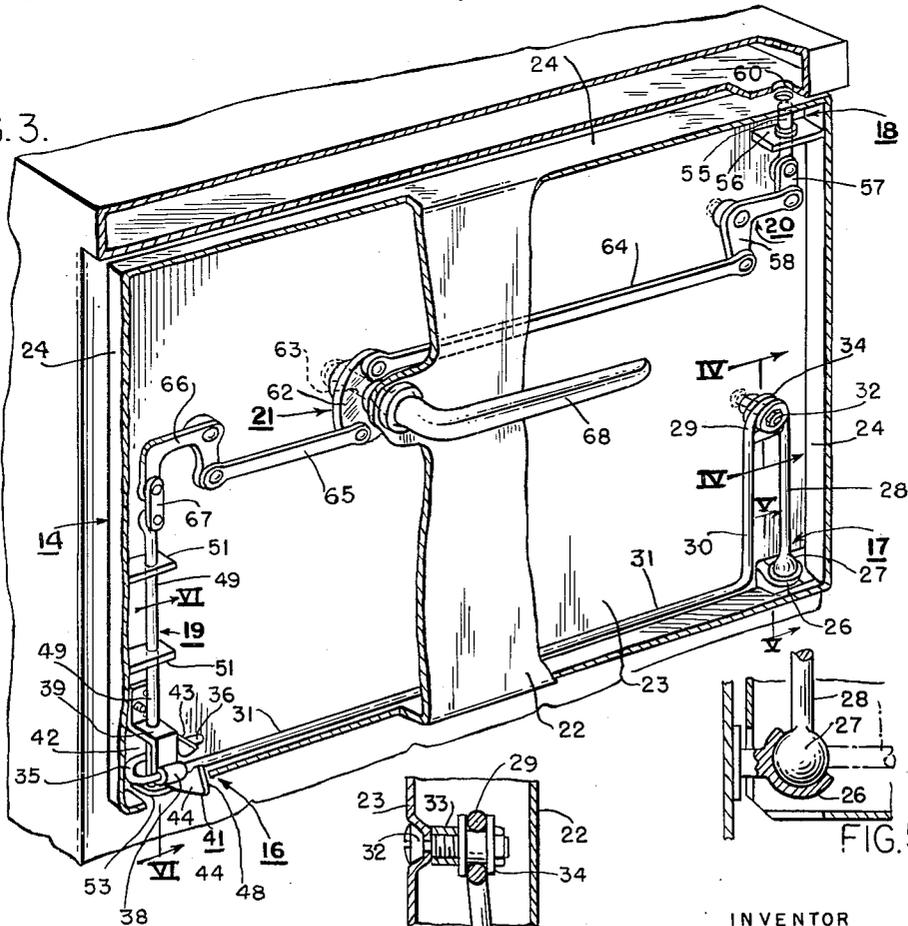
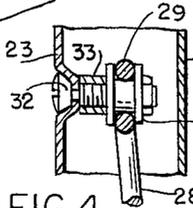


FIG. 5.

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FIG. 4.



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DOOR MOUNTING

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3 Claims. (Cl. 16-147)

This invention relates to closure mountings, more particularly to mountings for doors of domestic ovens and the like, and has for an object to enable an oven door to be pivoted about a horizontal axis and about a vertical axis, selectively.

For many years, oven doors were pivoted to open about a vertical axis adjacent one side of the door, this method of mounting the door permitting the housewife to stand or kneel close to the oven when cleaning the latter or when reaching into the rear portion of the oven for any reason. In recent years, most oven doors have been mounted for pivotal movement about a horizontal axis adjacent the bottom of the door, so that, when opened, the door functions as a shelf extending forwardly from the oven bottom wall for support of foods and cooking vessels before being placed in the oven or upon being removed therefrom for inspection or for serving.

Such horizontally-pivoted doors have the disadvantage that they prevent the housewife from standing directly in front of, and close to, the oven when cleaning the latter or when reaching into the rear portion thereof for any reason.

The present invention enables the housewife to obtain the advantages of both known types of door mountings, while avoiding the disadvantages thereof. To this end, the invention provides mounting means for an oven door such that the door may be pivoted about a vertical axis and about a horizontal axis, at the will of the user. In one form of the invention an oven door handle is movable between two positions to selectively render effective the pivots for one axis or the other. In one position of the handle the door pivots about a vertical axis and in another position of the handle the door pivots about a horizontal axis. In another form of the invention the door handle may be stationary, and shifting of the effective pivots effected by a manually operable latch.

Another object of the invention is to facilitate cleaning of an oven of the type in which the door is utilizable as a shelf.

A further feature of the present invention is the provision of a torsion bar, housed within the door structure, for applying to the door, as it is opened, a biasing force tending to urge the door toward closed position. Such an arrangement for counterbalancing the weight of the oven door is particularly useful with wall ovens and "stacked" ovens which have no free space therebeneath for location of the usual counterbalancing springs.

Another object of the invention is to provide oven door counterbalancing mechanism for ovens which are so located that no space is available therebelow for the usual counterbalancing mechanism.

Yet another object of the invention is the provision of an oven door counterbalancing mechanism which may be housed within the oven door structure.

The foregoing and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a perspective view of a free standing range whose oven door is mounted in accordance with the present invention, the door being shown pivoted to open position about a horizontal axis adjacent its lower edge;

FIG. 2 is a similar view of the same range with the door

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pivoted to open position about a vertical axis adjacent one of its side edges;

FIG. 3 is an enlarged perspective view of a portion of the structure shown in FIGS. 1 and 2, with the oven door closed and with portions of the door front panel broken away to more clearly illustrate mechanism housed within the door;

FIG. 4 is an enlarged fragmentary sectional view taken along line IV—IV of FIG. 3, looking in the direction indicated by the arrows;

FIG. 5 is an enlarged fragmentary sectional view taken along line V—V of FIG. 3, looking in the direction indicated by the arrows;

FIG. 6 is an enlarged fragmentary sectional view taken along the line VI—VI of FIG. 3, looking in the direction indicated by the arrows;

FIG. 7 is a fragmentary sectional view similar to FIG. 6, but showing a portion of the mechanism pivoted to a different position;

FIG. 8 is an enlarged fragmentary sectional view taken along line VIII—VIII of FIG. 6, looking in the direction indicated by the arrows;

FIG. 9 is a fragmentary side elevational view of the keeper element shown in FIGS. 6, 7 and 8.

FIG. 10 is a fragmentary perspective view similar to FIG. 3, but showing a modified construction.

FIG. 11 is a fragmentary sectional view taken along the line XI—XI of FIG. 10, looking in the direction indicated by the arrows;

FIG. 12 is a fragmentary vertical sectional view taken along the line XII—XII of FIG. 10, looking in the direction indicated by the arrows;

FIG. 13 is a fragmentary vertical sectional view taken along line XIII—XIII of FIG. 12, looking in the direction indicated by the arrows;

FIG. 14 is a fragmentary vertical sectional view taken along line XIV—XIV of FIG. 12, looking in the direction indicated by the arrows;

FIG. 15 is a fragmentary sectional view similar to FIG. 13, but showing the door in a horizontal position;

FIG. 16 is a fragmentary front elevational view of the upper right-hand corner of the structure shown in FIG. 10; and

FIG. 17 is a fragmentary sectional view taken along line XVII—XVII of FIG. 16, looking in the direction indicated by the arrows.

In FIGS. 1 to 9 there is shown a free standing range having an oven 10 in the upper portion thereof and a storage drawer 11 below the oven. The oven 10 is defined by top and bottom walls, side and rear walls and a front wall 12, the front wall 12 having an opening 13 therethrough providing access to the oven 10. The access opening 13 is provided with a closure in the form of a door 14 having novel structure for mounting the same on the oven front wall 12 so that the door may be moved between closed and open positions about either a horizontal axis adjacent its lower edge or about a vertical axis adjacent one of its side edges, as selected by the user.

In order to effect this novel pivotal arrangement there is provided a pivot structure 16, at the lower left of the door as viewed in FIGS. 1, 2 and 3, which functions only when the door pivots about the horizontal axis; a pivot structure 17 at the lower right of the door, which functions during pivotal movement of the door about both the horizontal axis and about the vertical axis; and a pivot structure 18 at the upper right-hand corner of the door, which functions as a pivot only during pivotal movement of the door about the vertical axis.

The invention includes the provision of pivot-adjusting mechanism 19 associated with the pivot structure 16 and pivot-adjusting mechanism 20 associated with the pivot

structure 18, together with manually operable means 21 for rendering effective the two adjusting means 19 and 20, selectively at the will of the user, so that as one pivot is rendered effective, the other pivot is rendered ineffective, and vice versa.

Referring now particularly to FIGS. 3, 6, 7 and 8, the door 14 includes spaced parallel front and rear panels 22 and 23, respectively, joined at their edges by a peripheral wall 24, the space between the panels serving to house the pivot structures 16, 17 and 18 and also the pivot adjusting mechanisms 19 and 20.

The pivot structure 17, at the lower right-hand corner of the door, as viewed in FIG. 3, functions during both horizontal pivoting and vertical pivoting of the door and, in the construction herein illustrated, comprises a socket 26 mounted on the front wall 12 of the oven and extending through an appropriate opening in the door rear panel 23. The socket 26 rotatably receives the mating ball portion 27 housed in the space between the door panels and carried at the free end of a leg 28 of an inverted U-shape loop 29 whose other leg 30 constitutes a right angled extension of a torsion bar 31 which extends transversely of the door substantially along the horizontal axis about which the door pivots. The inverted U-shape loop 29 is anchored within the door by suitable means, such as the bolt 32, sleeve 33, and flanged collar 34, best shown in FIG. 4.

As best shown in FIG. 5, the opening in the socket 26, through which a portion of the ball 27 and its associated leg 28 extend, lies in a plane disposed at substantially 45° with respect to the vertical in order that the leg 28 may extend vertically with respect to the socket when the door is closed, or when it is pivoted open about the vertical axis, and may extend horizontally, as indicated by dot-dash lines, when the door is fully opened about the horizontal axis.

Considering now the pivot structure 16, shown at the lower left-hand corner of the door as viewed in FIG. 3, it will be seen that the left-hand end of the torsion rod 31 is bent through 180° to provide a U-shaped terminal portion 35 whose legs are comprised by the free leg 36 and the extreme left-hand portion 31a of the torsion rod 31. The left-hand end of torsion rod 31, and its U-shaped terminal portion 35, are supported with respect to the door by reception of portion 31a of the torsion rod within the loop 38 of a stepped strap 39, which is rigidly secured to the rear panel 23 of the door. The pivot structure 16 includes, in addition to the U-shaped terminal 35 of the torsion rod, a keeper 41 permanently secured to the oven front wall 12 by a lateral flange 42. The keeper includes a pair of vertically spaced arms 43 and 44 lying in a common vertical plane disposed normal to the front wall of the oven, the vertical spacing of the arms 43 and 44 providing a forwardly opening notch 45 therebetween which is adapted to receive the free leg 36 of the U-shaped terminal 35 of the torsion rod 31. As shown in FIGS. 6 and 9, the lower arm 44 of the keeper is provided with an upwardly opening notch 47 for reception of the other leg 31a of the torsion rod terminal 35.

As best indicated in FIG. 6, by the dot-dash showing, the U-shaped terminal portion 35 of the torsion rod 31, when unrestrained by the keeper, lies in a plane inclined upwardly and rearwardly, with the result that the leg 36 is normally disposed rearwardly and slightly above the other leg 31a when the door is open. By reference to FIG. 6, it is apparent that when the door is swung about its vertical axis from open position to closed position, the leg 36 of the U-shaped terminal portion will not be aligned with the notch 45 between the vertically spaced arms of the keeper. Accordingly, the outer or forward end of the upper arm 43 is inclined downwardly and inwardly to provide a cam surface 46 which will deflect the leg 36 of the U-shaped terminal portion downwardly into the notch 45 as the door is closed. Since this downward deflection of the leg 36 will tend to deflect the other leg

31a downwardly also, the outer or forward end of the keeper arm 44 is reversely inclined upwardly and rearwardly to provide a cam surface 48 for deflecting and guiding the leg 31a upwardly into the notch 47 in which it fits when the door is fully closed.

Inasmuch as the leg 36 is biased downwardly with respect to the leg 31a when the door is closed, it will be apparent that a torsional force is applied to the torsion bar 31, since the other end of the torsion bar is restrained against rotation about its longitudinal axis by the retention of the loop 29 in the space between the door front and rear panels. This torsion force acts through the leg 30 at the right-hand end of the torsion bar, to urge and retain the door in closed position. It will be apparent that when the door is swung to open position, about its horizontal axis, the torsion force applied to the rod is materially increased, since the leg 30 will now be disposed horizontally while the loop 35 at the other end of the torsion bar is retained in its substantially horizontal position by the keeper 41. This added torsion force is the equivalent of the counterbalancing force normally supplied to conventional doors by the counterbalancing springs which are usually located in the space below the oven chamber in free standing ranges. Since such space is not necessarily available in built-in ovens or in stacked ovens which are disposed on existing countertops, the present invention finds particular utility in such installations by eliminating the necessity for any counterbalancing springs which would normally be positioned below the bottom wall of the oven chamber.

While the twisting action applied to the torsion bar terminal loop 35 by the keeper 41 normally is sufficient to prevent any accidental withdrawal of the loop from the keeper, such accidental withdrawal would be undesirable if the pivot structure 18 at the upper right-hand corner of the door, as viewed in FIG. 3, were not adjusted to be effective. The present invention provides, as an additional safety feature, means for preventing such accidental withdrawal of the loop 35 from the keeper in the event it is attempted to open the door about its vertical axis while the upper vertical axis pivot structure 18 is ineffective. To this end, there is provided a locking rod 49 vertically reciprocable through aligned openings in one or more supporting brackets 51 (FIG. 3), carried by the door panel structure, and in the stepped bracket 39. The lower free end of the locking rod is adapted to be received in an opening 52 provided in a leg 53 extending laterally from the keeper 41 at the bottom of the latter. As best shown in FIGS. 6 and 7, this engagement of the locking rod 49 in the arm 53 will not interfere with pivotal movement of the door about its horizontal axis, since the lower end of the rod 49 will move upwardly out of the opening 52 as the door pivots about the arm 31a (FIG. 7). In this connection, it may be desirable to chamfer the rear edge of the lower end of the rod 49, as at 50. Also, this structure is so designed that the lower end of the rod 49 will clear the other leg 36 of the U-shaped torsion rod terminal as the door is further lowered into horizontal open position. The path that the lower end of the locking rod 49 follows during opening movement of the door about its horizontal axis as indicated by the solid arrow in FIG. 7. Similarly, the path that the rear edge of the door follows, with respect to the front wall of the oven, is indicated by the dotted arrow in that same figure. The locking rod 49 operates in conjunction with adjustment of the pivot structure 18, at the upper right-hand corner of the door, in a manner to be hereinafter described.

Referring now to the pivot structure 18, at the upper right-hand corner of the oven door as viewed in FIG. 3, there is shown a pivot pin 55 whose longitudinal axis coincides with the vertical axis of the door. This pivot pin is mounted to reciprocate vertically in a supporting bracket 56 carried by the door structure and is supported at its lower end by a link 57 connecting it with one arm of a bell crank 58. When the pivot pin is moved up-

wardly its free end will extend through an opening in the peripheral wall 24 of the door and into an aligned opening 60 in the lower surface of the oven top wall. The walls of this opening 60 function as a bearing for the pivot pin 55 about its vertical axis.

Since the pivot pin 55 must be retracted or lowered in order for the door to pivot about its horizontal axis, and since the locking rod 49 of the pivot structure 16 must be moved upwardly for pivotal movement of the door about its vertical axis, the mechanism 21 has been provided for making simultaneous adjustments of these two elements. The mechanism 21 includes a disc 62 secured on a rotatable shaft 63 carried by the door front and rear panels. A link 64 connects the disc with an arm of the bell crank 58 while another link 65 connects the disc 62 to the bell crank 66. This latter bell crank is connected by a link 67 to the upper end of the locking rod 49. Since the links 64 and 65 connect to the disc 62 at points adjacent the periphery thereof which are substantially diametrically opposed, rotation of the disc in clockwise direction, as viewed in FIG. 3, will move the pivot pin 55 upwardly into operative position and will simultaneously move the locking rod 49 upwardly into inoperative position to permit the U-shaped terminal 35 of the torsion rod 31 to be disengaged from the keeper as the door is pivoted about its vertical axis to open position. Conversely, rotation of the shaft 63 and disc 62 in counterclockwise direction will retract the pivot pin 55 and move the locking rod 49 downwardly to its locking position within the opening 52 of the arm 53.

While any suitable means may be provided for rotating the shaft 63 and its associated disc 62, the present invention provides a manually-operable handle 68 drivenly secured to the shaft 63 and disposed forwardly of the front panel 22 of the door, where it may be readily grasped by the hand of a user. Preferably, the handle is so disposed on the shaft 63 that, when the handle is in the horizontal position shown in FIGS. 1 and 3, the adjusting mechanism will have retracted the pivot pin 55 and locked U-shaped terminal 35 to prepare the door mounting mechanism for pivotal movement of the door about its horizontal axis. Similarly, when the handle is disposed in vertical position, as illustrated in FIG. 2, the door mounting mechanism will be positioned to prepare the door for pivotal movement about the vertical axis with the pivot pin 55 extended into the opening 60 of the oven top wall and with the locking rod 49 raised to permit disengagement of the U-shaped terminal 35 from the keeper 41.

Operation of Mechanism of FIGS. 1 to 9, Incl.

When it is desired to open the door by pivoting it about its horizontal pivotal axis, the handle 68 is turned counterclockwise to the horizontal position shown in FIG. 3, thereby rotating the bell crank 58 clockwise to retract the pivot pin 55 from its pivotal bearing in opening 60, and simultaneously rotating the bell crank 66 counterclockwise to move the locking rod 49 downwardly into opening 52 in the leg 53, thus positively preventing withdrawal of the torsion rod terminal loop 35 from its keeper 41. As soon as the handle 68 has been rotated to its horizontal position, the door may be pivoted about its horizontal axis with the ball 27 rotating in its socket 26 through approximately 90 degrees, as shown in FIG. 5. During this opening movement, the torsion rod terminal loop 35 is held against rotation by the keeper 41. At the same time, the other end of the torsion rod 31, at 30, is rotated through approximately 90 degrees, thereby producing in the torsion rod 31 a force offsetting a portion of the weight of the door and urging the door towards closed position. This force stored in the torsion rod during opening of the door about its horizontal pivotal axis corresponds to the counterbalancing force normally obtained by the use of levers and springs housed in the range cabinet structure in available space below the oven.

Referring now to FIGS. 10 to 17 inclusive; there is shown a modified door mounting structure in which the locking rod 49 of the previously described embodiment is omitted, as can be safely done when manufacturing tolerances are sufficiently strict to insure firm retention of the torsion rod U-shaped terminal portion 35 in the keeper 41.

The pivotal structure 16 at the lower left-hand corner of the door is identical in both constructions, with the exception just mentioned, i.e., the omission of the locking rod 49.

In place of the ball and socket pivot for both horizontal and vertical axes, there is provided a double acting pivot which includes a loop 71 carried at the forward free end of a horizontally extending arm 72 of a bracket 73 which is fixedly secured to the front wall 12 of the oven. This loop 71 rotatably supports a short shaft 74 having at one end a loop or eye 75 receiving a pivot pin 76 carried by a bracket 77 which is secured to the door structure. By this construction the door may pivot about a horizontal axis which coincides with the longitudinal axis of the short shaft 74 by rotation of this shaft in the loop or sleeve 71 of the bracket 73. When the door is to be swung about its vertical pivotal axis, the loop or eye 75 of the shaft 74 will swing on the pivot pin 76, carried by the bracket 77. The longitudinal axis of the pivot pin 76 coincides with the pivotal axis for the door.

Since the ball and socket construction are omitted in this modification, the means for retaining the right-hand end of the torsion bar 131 may be simplified by providing a simple extension 132 at right angles to the torsion bar 131, together with a suitable bracket 81 secured to the door structure and retaining the free end of the torsion bar terminal 132. Preferably, the right-hand end of the torsion bar 131 is supported by passing through a loop 78 of a bracket 79 carried by the door structure.

Since the locking rod is omitted in this modification, it is not necessary to provide any interlock or adjusting mechanism for simultaneously rendering one pivot effective and the diagonally opposite pivot ineffective. Consequently, the door in this modification is provided with a somewhat conventional handle 82 extending parallel to and near the upper edge of the door and mounted thereon in the usual manner by bolts 83 and spacer discs 84 (FIGS. 16 and 17).

The pivot pin 55 at the upper right-hand corner of the door, as viewed in FIG. 10, is positioned at all times in the opening in the upper peripheral wall 24 of the door, and is supported at its lower end by a pin 85 extending through its eye or loop 86 and carried by one end of a stepped lever 87, located between the door front and rear panels 22 and 23 respectively. The stepped lever 87 is secured to, and supported by, an operating shaft 88 pivotally mounted in aligned openings in the door front panel 22 and in the rear wall of the door handle 82 (FIGS. 16 and 17).

A latch member 89 is carried by the forward end of the shaft 88, which projects into the space provided between the front and rear walls of the door handle. The latch 89 is non-rotatably secured on the shaft 88 and extends laterally therefrom to the left, as viewed in FIGS. 10 and 16. When the latch 89 is moved downwardly from the position shown in full lines in FIGS. 10 and 16, where it is concealed within the door handle 82, to the position indicated by the dot-dash lines in FIG. 16, the pivot pin 55 is moved from its retracted position shown in full lines in FIGS. 10 and 17 to its operative position shown in dot-dash lines of FIGS. 16 and 17, where its free end will extend through aligned openings in the oven top wall and in an overlying bracket 90.

As best shown in FIG. 10, the latch 89 is provided with a finger piece 91, disposed forwardly of latch 89, and easily engaged by the finger of a user by reaching up into the space within the door handle 82, where the latch is located.

It will be apparent that, with this construction, the housewife will normally open the oven door by pivoting it about its horizontal pivots and for this type of opening movement the horizontally disposed handle is preferable. When it is desired to clean the oven or when the housewife needs to stand close to the oven for any other reason, the door may be freely rotated about its vertical pivotal axis by merely pulling down on the latch 89, thereby rendering the pivot pin 55 operative, and then grasping the handle 82 adjacent the left-hand end of the door, as viewed in FIG. 9, and swinging the door about its vertical axis.

While the invention has been shown in two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. A vertical wall having an opening therethrough, a rectangular door for said opening, means mounting said door for pivotal opening and closing movement selectively about a horizontal axis adjacent its lower edge and about a vertical axis adjacent one of its side edges, said mounting means including a pivot common to both of said axes adjacent their point of intersection, a torsion rod extending transversely of said door adjacent said horizontal axis, a keeper carried by said vertical wall and having a notch for reception of a first terminal portion of said torsion rod which is remote from said common pivot, said keeper providing a support for said rod during pivotal movement of said door about said horizontal axis and releasing said rod for pivotal movement of said door about said vertical axis, said keeper including means for preventing rotation of said first terminal portion of said rod relative to said keeper during pivotal movement of said door about said horizontal axis, and means restraining the other terminal portion of said rod against rotation relative to said door, whereby pivotal movement of said door about said horizontal axis in the opening direction applies a torsional force to said rod tending to close said door.

2. A vertical wall having an opening therethrough, a rectangular door for said opening, means mounting said door for pivotal opening and closing movement selectively about a horizontal axis adjacent its lower edge and about a vertical axis adjacent one of its side edges, said mounting means including pivot structure for both of said axes adjacent their point of intersection, a torsion rod extending transversely of said door adjacent said horizontal axis, a keeper carried by said vertical wall and having a notch for reception of a first terminal portion of said torsion rod which is remote from said pivot structure, said keeper providing a support for said rod during pivotal movement of said door about said horizontal axis and releasing said rod for pivotal movement of said door about said vertical axis, said keeper including means for preventing rotation of said first terminal portion of said rod relative to said wall during pivotal movement of said

door about said horizontal axis, means restraining the other terminal portion of said rod against rotation relative to said door, whereby pivotal movement of said door about said horizontal axis in an opening direction applies a torsional force to said rod tending to close said door, and a pivot pin carried by said door and disposed with its axis coinciding with said vertical axis and adjacent a corner of said door remote from said pivot structure, said pivot pin being adjustable between an operative position where it projects beyond the periphery of the door and is rotatably received in a mating opening in the vertical wall, and an inoperative position where it is retracted from said mating opening.

3. A vertical wall having an opening therethrough, a rectangular door for said opening, means mounting said door for pivotal opening and closing movement selectively about a horizontal axis adjacent its lower edge and about a vertical axis adjacent one of its side edges, said mounting means including pivot structure for both of said axes adjacent their point of intersection, a torsion rod extending transversely of said door adjacent said horizontal axis, a keeper carried by said vertical wall and having a notch for reception of a first terminal portion of said torsion rod which is remote from said pivot structure, said keeper providing a support for said rod during pivotal movement of said door about said horizontal axis and releasing said rod for pivotal movement of said door about said vertical axis, said keeper including means for preventing rotation of said first terminal portion of said rod relative to said wall during pivotal movement of said door about said horizontal axis, means restraining the other terminal portion of said rod against rotation relative to said door, whereby pivotal movement of said door about said horizontal axis in an opening direction applies a torsional force to said rod tending to close said door, a pivot pin carried by said door and disposed with its axis coinciding with said vertical axis and adjacent a corner of said door remote from said pivot structure, said pivot pin being adjustable between an operative position where it projects beyond the periphery of the door and is rotatably received in a mating opening in the vertical wall, and an inoperative position where it is retracted from said mating opening, and manually operable means for adjusting said pivot pin to its operative and inoperative positions.

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