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[54] **APPLIANCE DOOR CONTROL MECHANISM**

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Related U.S. Application Data

[63] Continuation of Ser. No. 163,047, July 15, 1971, which is a continuation of Ser. No. 820,735, May 1, 1969, abandoned.

[52] **U.S. Cl.** **312/276,** 49/386, 312/319

[51] **Int. Cl.** **A47b 81/00**

[58] **Field of Search** 49/386; 312/276, 319

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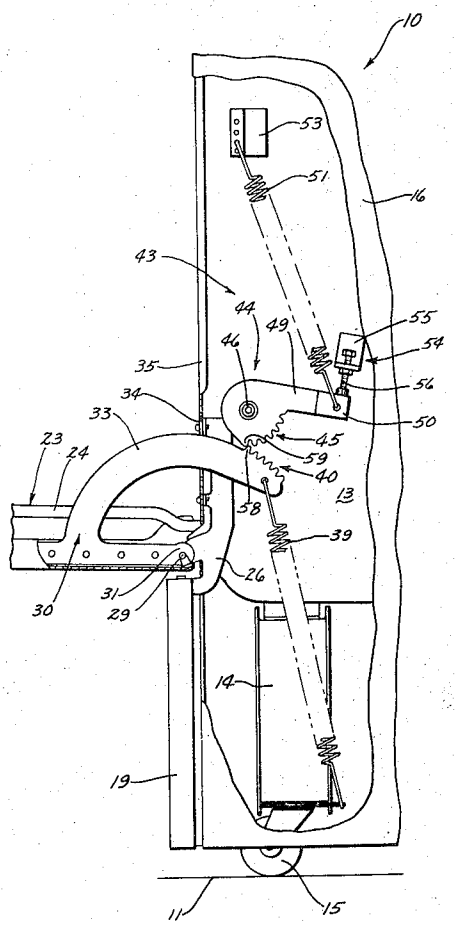
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[57] **ABSTRACT**

A door control mechanism for an appliance is operable for controlling movement of the door between a substantially horizontal normally open position and an overload position at which a portion of the door engages the floor. The door control mechanism is preloaded to maintain the door in the horizontal position when supporting less than a predetermined loading but will effect movement of the door to the floor responsive to an overloading of the door for preventing tipping of the appliance.

14 Claims, 5 Drawing Figures



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Fig. 1

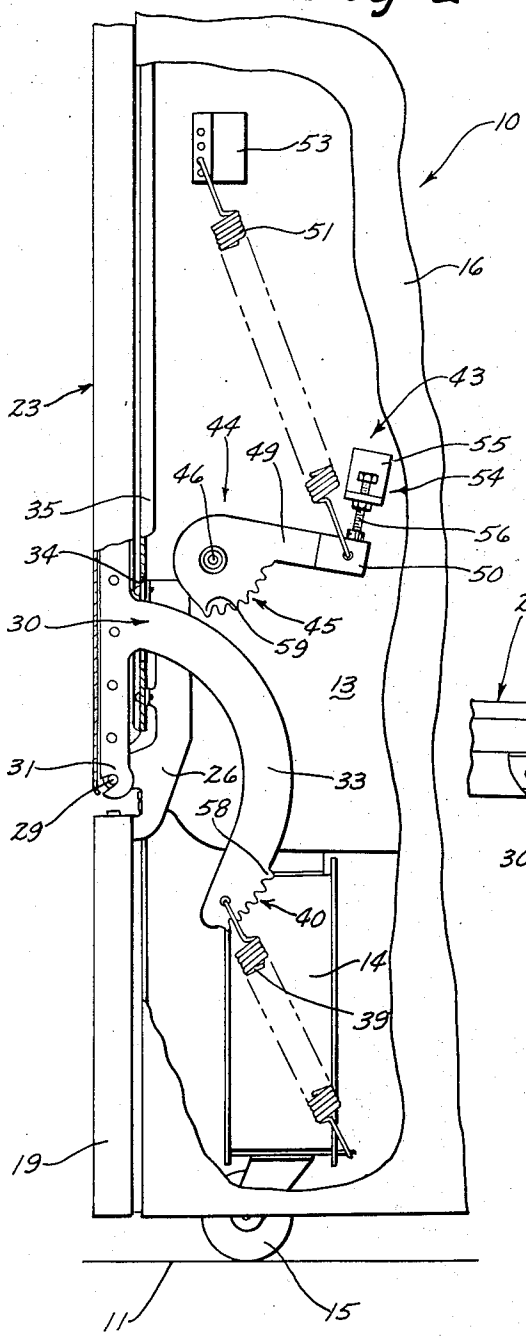
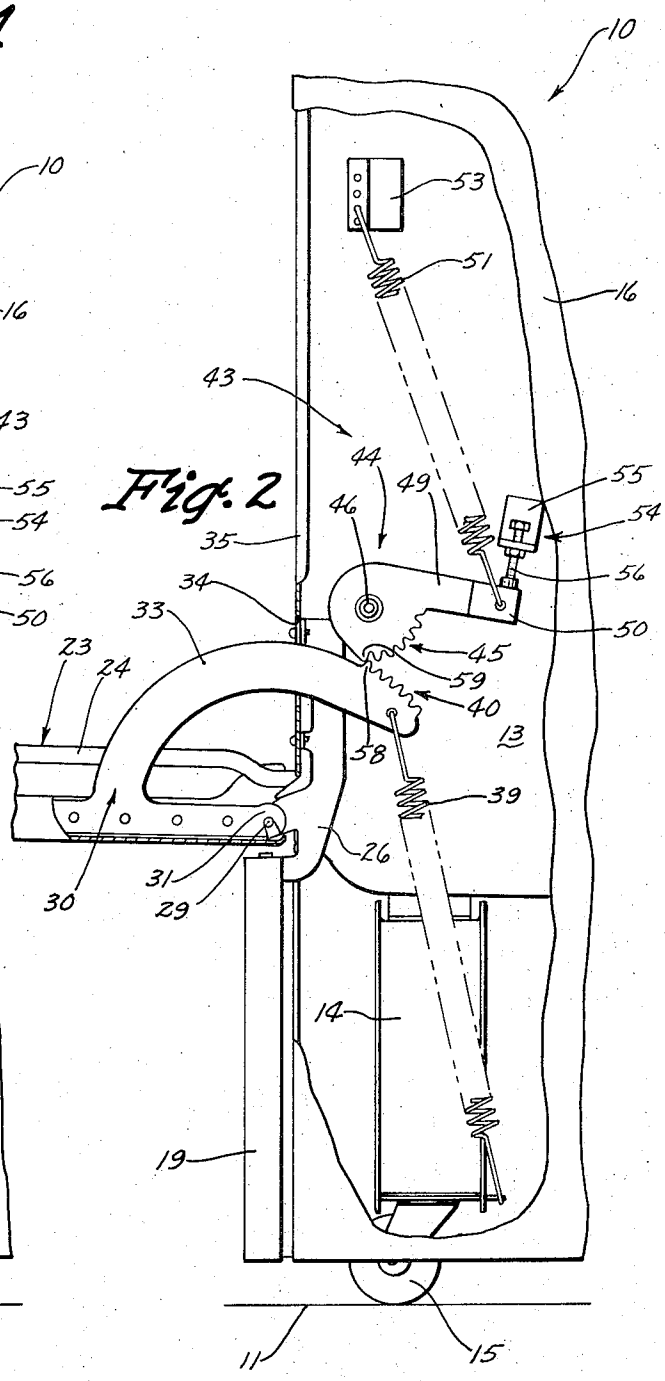
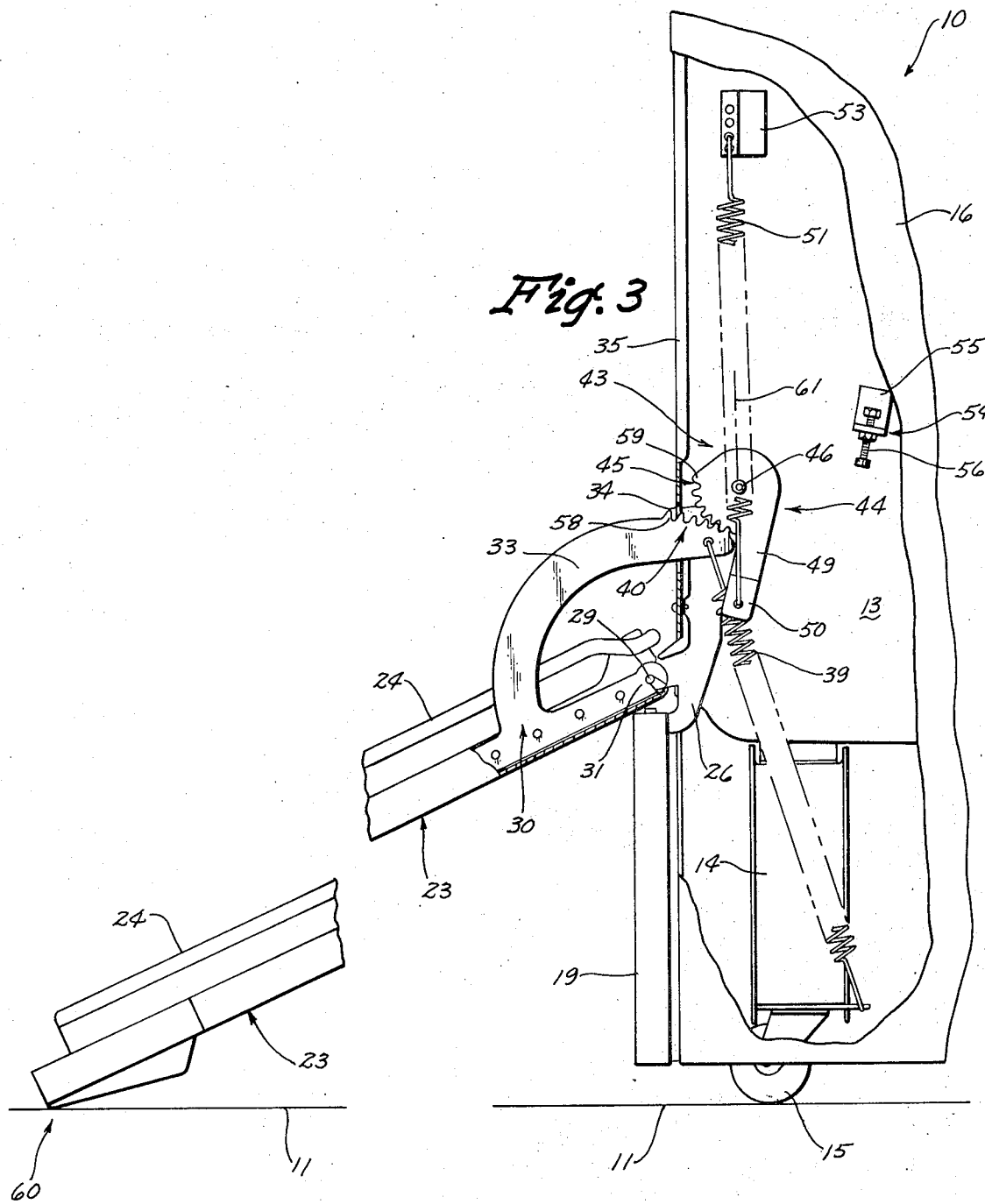


Fig. 2



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Fig. 3



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Fig. 4

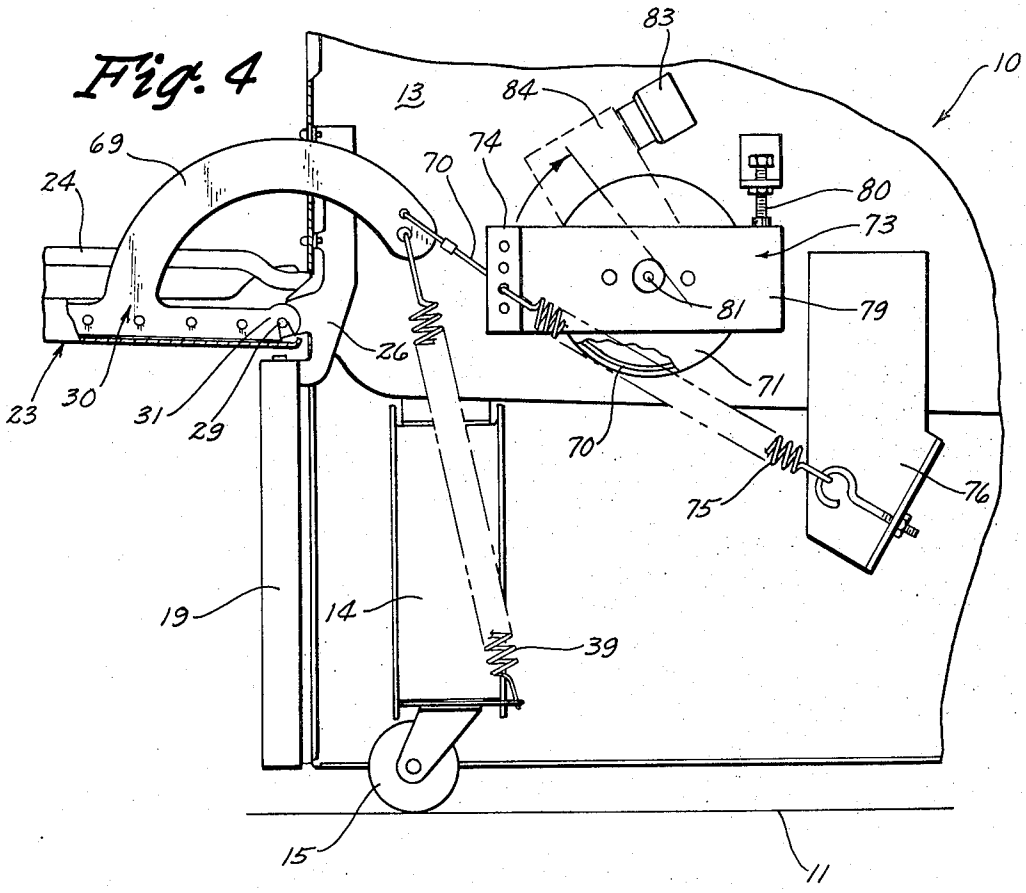
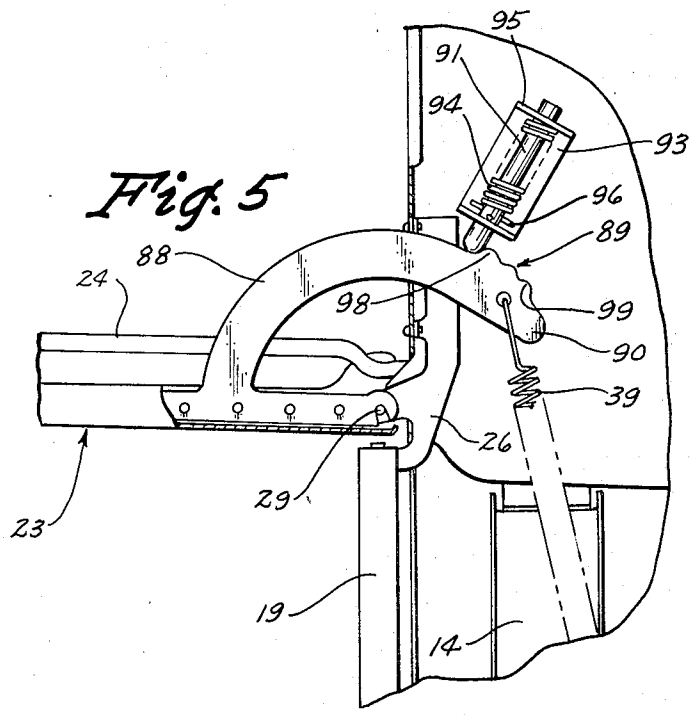


Fig. 5



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APPLIANCE DOOR CONTROL MECHANISM

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation of application Ser. No. 163,047, filed July 15, 1971 which in turn is a continuation of application Ser. No. 820,735 filed May 1, 1969, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a door control mechanism for an appliance operable for preventing tipping of an appliance when an overload is placed on the open door.

2. Description of the Prior Art

It is common in the field of home appliances having an access opening in a side wall to provide a closure member or door for selectively closing the access. Most frequently the door is hinged to the cabinet structure and operates from a closed position to a substantially horizontal open position. If an overload were applied to the outwardly extending end of the substantially horizontal door, the appliance could tip over and result in injury to persons close to the appliance and also result in damage to the appliance. The problem of appliance upsetting could be overcome, as in prior art, by providing outrigging devices or bracing. Previously used devices, however, represent unattractive and expensive solutions to the problem and thus there remains a need to provide an improved means for preventing the upsetting of an appliance.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide an improved system for preventing the upsetting of an appliance responsive to the overloading of a door in an outwardly extending open position.

It is a further object of the instant invention to provide door control means for an appliance door to control movement of the door between a normally open substantially horizontal position and an overload position.

It is a further object of the instant invention to provide an appliance having a hinged door operable to a substantially horizontal open position and having a yieldable connection between the door and the cabinet structure operable for positioning the door for normal use and responsive to an overload condition for releasing the door for movement to the floor.

It is yet a further object of the instant invention to provide means operable in an appliance for locating and yieldingly maintaining a hinged door in a substantially horizontal position and responsive to an overload on the open door for permitting movement of the door to the floor from the horizontal position.

These objects are achieved in an appliance having a door hinged at the bottom on one side of the cabinet and controlled for movement between a substantially horizontal normally open position and an overload position engaging the floor. The control mechanism locates the door in the normal open position and yieldingly maintains the door in the open position when loaded below a predetermined load and effects movement of the door to the floor when an excess load is applied to the appliance door.

Operation of the device and further objects and advantages thereof will become evident as the description proceeds proceeds and from an examination of the accompanying three pages of drawings.

DESCRIPTION OF THE DRAWINGS

The drawings illustrate preferred embodiments of the invention with similar numerals referring to similar parts throughout the several views, wherein:

FIG. 1 is a fragmentary view of a dishwasher appliance showing the door in the closed position and having portions broken away to show the instant invention;

FIG. 2 shows a fragmentary portion of a dishwasher appliance similar to FIG. 1 and with the door shown in the open substantially horizontal position;

FIG. 3 shows a fragmentary portion of a dishwasher appliance showing the appliance door in the overload position engaging the floor and showing further details of the operation of the instant invention;

FIG. 4 shows a fragmentary portion of a dishwasher appliance including an alternate embodiment of the instant invention; and,

FIG. 5 also shows a fragmentary portion of a dishwasher appliance and illustrates a still further embodiment of the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, there is shown a fragmentary portion of a dishwashing appliance. A cabinet structure **10** is supportable on a horizontal surface **11** and includes a tub-like member **13** defining a washing chamber, a supporting frame **14** for supporting the tub member **13** on the horizontal surface **11** through a plurality of casters or rollers **15**, a sheet metal wrapper or housing **16** enclosing the tub member **13** and supporting frame **14**, and a removable lower front panel **19**.

The cabinet structure **10** defines an access opening into the washing chamber on one of the substantially vertical sides of the cabinet structure **10**. A door **23** is mounted on the cabinet structure **10** and includes a seal member **24**, as best shown in FIGS. **2** and **3**, for sealing the access opening upon movement of the door **23** to a substantially closed position as shown in FIG. **1**. In this application, the front side of the appliance will be considered that side having the access opening and the door **23**.

Means are provided for hinging the door **23** to the cabinet structure **10** through a pair of hinges each of which includes a hinge bracket **26** fixed to the cabinet structure **10** and a hinge pin **29** in turn fixed to the hinge bracket **26**. Fixed to the movable door **23** is a bracket member **30** including a slotted pivot portion **31** engageable with the hinge pin **29** for supporting the lower end of the door **23** on the hinge brackets **26**. The bracket member **30** also includes an arcuate arm portion **33** extending through an opening **34** in a flange **35** of the cabinet structure **10** beside the tub member **13**. The end of the arcuate arm portion **33** receives one end of a door biasing spring member **39** attached at the other end to the mounting means **14**. The spring member **39** partially compensates for the weight of the door **23** in the open position and biases the door **23** to the closed position. The end of the arcuate arm portion **33** also includes a plurality of teeth forming a gear segment **40** operable about the pivot pin **29** and forming

a part of a preferred embodiment of the instant invention as will be more fully explained hereinafter.

In accordance with the instant invention, door movement control means **43** are positioned between the juxtaposed walls of the tub member **13** and the enclosure **16** and are cooperable with the gear segment **40** on the arcuate arm portion **33** to control the movement of the appliance door **23.**

A gear member **44** is pivotally mounted on the side of the tub member **13** and includes a gear segment **45** operable about the pivot pin **46** supporting the gear member **44.** The gear member **44** includes an outwardly extending arm **49** having an offset end portion **50** to which is connected one end of a biasing spring **51** of which the opposite end is connected to a bracket **53** fixed to the wall of the tub member **13.** An adjustable stop means **54,** including a bracket **55** fixed to the wall of the tub member **13** and a threaded member **56,** limits the counterclockwise rotation of the gear member **44** about the pivot pin **46.** A preload force on the biasing spring **51** maintains the gear member **44** against the adjustable stop **54.**

Referring to FIG. **2,** it is seen that as the door **23** is moved to an open position with the door extending outwardly from the cabinet **10** in a substantially horizontal direction the arcuate arm member **33** moves about the hinge pin **29** to position the gear segment **40** on the arcuate arm portion **33** for engagement with the gear segment **45** of the tub-mounted gear member **44.** The first tooth **58** of the gear segment **40** on the door-mounted arcuate arm **33** will in fact engage the first tooth **59** of the tub-mounted gear member **44** to serve as a stop or locater means for the door **23** under the preloading force of the gear member biasing spring **51.** The preload on the gear member **44** will effectively maintain the door **23** in the horizontal position as shown in FIG. **2** under a preselected normal door loading including a rack of dishes (not shown). It is noted also that the door biasing spring **39** is extended to at least partially compensate for the weight of the door **23** and the weight of the rack and dishes.

The biasing effect of the door spring **39** and the preload on the gear member spring **51** cooperate to effectively maintain the door **23** in the horizontal position as shown with a preselected door loading such as a 45 pound load of rack and dishes. If, however, the load on the door exceeds a normal maximum load, such as a total of 50 pounds, the preload force on the gear member **44** will be overcome and the door **23** will move downwardly from the horizontal position.

Referring now to FIG. **3,** the dishwasher appliance door **23** is shown in the overload position with an edge **60** of the door engaging the floor surface **11.** When the overload is applied to the open door **23,** the forces are transmitted through the engaging gear segments **40** and **45** and the movement of the arcuate arm **33** about the hinge pin **29** effects movement of the tub-mounted gear segment **45** about the pivot pin **46.** As the gear segment **45** is moved about the pivot pin **46,** the gear member biasing spring **51** is extended to provide additional resistance to the movement of the door **23.**

Assuming that the overload remains on the appliance door **23,** the door will move to the position shown in FIG. **3** with the edge **60** of the door engaging the floor. Immediately prior to the engagement of the door **23** with the floor **11,** the center line **61** of the gear member biasing spring **51** passes over the pivot point **46** of the gear member **44** as an over-center spring. The over-center spring characteristic biases the gear member **44** in a clockwise direction about the pivot pin **46** and effectively holds the door **23** against the floor to prevent spring back of the door toward the cabinet structure **10.**

It is thus possible to understand that the gear action, in cooperation with the forces acting through the springs, give controlled movement to an overloaded door. In the absence of movement control means as disclosed in the instant invention, the door could operate as a freely released door and could cause injury or damage as it moves unchecked to the floor. A feature of the instant invention would thus be the limiting of the rate of movement of the door under an overloading thereof.

The door **23** may be easily reset to its normal open position simply by manually lifting the door from the floor so that the spring **51** goes back over center to reposition the door for subsequent safe operation.

Referring to FIG. **4,** there is shown an alternate embodiment in which a linkage system replaces the mating gear segments shown in FIGS. **1** through **3.** This system is operable on a door **23** similar to that shown in FIGS. **1** through **3** and also includes an arcuate arm portion **69** mounted on the movable door **23.** The door is similarly biased by a spring **39** operating between the end of the arcuate arm **69** and the supporting frame **14** of the appliance.

In this alternate embodiment, a linkage in the form of a cable **70** is attached to the end of the arcuate arm **69** and to a pulley or wheel member **71** that is rotatably mounted to the tub member **13.** A plate **73** is fixed to the pulley **71** for rotation therewith and includes a flanged end **74** for receiving one end of a biasing spring **75** of which the opposite end is fixed to the tub **13** through a bracket **76** mounted thereon. The opposite end **79** of the pulley-mounted plate **73** is engageable with an adjustable stop **80** fixed to the side of the tub **13.**

In this alternate embodiment, the biasing spring **75** is connected between the plate **73** and the tub **13** and is preloaded to maintain the plate **73** in the position shown in FIG. **4** for locating the door **23** to the substantially horizontal position. Upon the application of an overload to the door **23,** the door will move from the position shown downwardly toward the floor **11** and the overload force will be transmitted through the cable **70** to the rotatably mounted pulley **71** and plate **73.** The cable will unwind from the pulley **71** and the pulley and plate assembly will move in a clockwise direction as the door moves toward the floor. Immediately prior to the point at which the door **23** engages the floor **11,** the spring **75** will pass over the pivot point **81** so that the pulley **71** is biased in a clockwise direction. This corresponds to the over-center operation described in FIG. **1.** The flanged end **74** of the plate **73** will engage a bumper means **83** fixed to the tub **13** for limiting movement of the plate and pulley to a position as shown in broken lines **84** in FIG. **4.** This position of the pulley and the plate assembly corresponds to the position at which the door engages the floor along the top edge of the door.

The biasing spring **75** is connected between the plate **73** and the bracket **76** in the embodiment of FIG. **4** to provide a substantially constant torque on the plate **73** through the major portion of the plate movement. It

will be seen that as the spring **75** extends to apply greater loading on the plate **73** the moment arm of the force acting about the pivot point **81** is reduced. The spring **51** shown in FIG. **1** may also be relocated to achieve this constant torque operation if desired.

The plate **73** and pulley **71** may be reset to the normal preloaded condition by the attachment of a cable or linkage (not shown) to the plate and manually operable for moving the plate and pulley assembly in a counterclockwise direction and passing the spring **75** back over the pivot point **81** so that the mechanism returns to its normal full line position as shown in FIG. **4**.

Referring now to FIG. **5** there is shown a still further embodiment of the instant invention in which a detent mechanism is substituted for the meshing gear segments of FIGS. **1, 2,** and **3** and for the linkage system of FIG. **4**. In the embodiment of FIG. **5,** a dishwasher includes a hinged door **23** as shown in the previous figures. An arcuate arm portion **88** is attached to the movable door and extends into the space between the tub member **13** and the outer enclosure as previously shown and includes an undulating cam surface **89** on the outer arcuate surface adjacent the rear end **90.** The cam surface **89** is engageable by the plunger **91** movably mounted on the wall of the tub **13** by flanged bracket **93** fixed to the wall. The plunger **91** is biased in a generally downward direction for engagement with the cam surface **89** of the arcuate arm **88** by a spring **94** operating between the upper flange **95** of the bracket **93** and a pin **96** fixed to the plunger **91.**

The plunger **91** engages the arcuate arm **88** next to a first undulation **98** of the cam surface **89** and under preload biasing of the spring **94** yieldingly maintains the door **23** in the substantially horizontal open position as shown in FIG. **5.** If the load on the door **23** exceeds a predetermined maximum, the biasing force of the spring **94** is overcome and the plunger **91** is forced upwardly and rides over the first undulation **98.** If the overload remains on the door **23,** the door will move downwardly toward the floor and the plunger **91** will ride over the cam surface **89** to a point past the last undulation **99** to effectively maintain the door **23** in the overload position. If, however, the overload force is momentary and is removed before the door engages the floor, the cooperation of the cam surface **89** and the plunger **91** will control movement of the door and position the door at some point between its normal horizontal position and the overload position.

This system may be easily reset by the operator by simply lifting the door **23** and applying sufficient force to overcome the biasing of the plunger **91** so that the arcuate arm **88** may be moved in a clockwise direction about the hinge pin **29** to its normal position shown in FIG. **5.**

It is therefore seen that the instant invention provides a door movement control mechanism operable on a hinged door of a dishwasher appliance, for example, to permit normal use of the door with loadings not exceeding a predetermined critical load. The system shown in this application is operable for effecting a controlled movement of the door responsive to an overloading. The system is easily reset following an overloading and does not include exposed outrigging or bracing. The system effectively prevents tipping of the appliance to avoid injury to the operator and damage to the appliance. Furthermore, this invention is useful on built-in appliances having a door openable to a substantially horizontal position for preventing damage to the door or the appliance in case an overload is applied to the open door.

In the drawings and specification, there has been set forth a preferred embodiment of the invention and although specific terms are employed these are used in a generic and descriptive sense only and not for purposes of limitation. Changes in form and the proportion of parts as well as the substitution of equivalents are contemplated as circumstances may suggest or render expedient without departing from the spirit or scope of this invention as further defined in the following claims.

I claim:

1. In a front opening appliance including a cabinet structure supportable juxtaposed a substantially horizontal surface and having an access opening on one side; door means normally operable between a closed position covering said access opening and an open position extending substantially horizontally from said cabinet structure spaced above said horizontal surface and hinge means including a hinge pin juxtaposed the lower portion of said door means for pivotally supporting said door on said cabinet structure, wherein the improvement comprises: a first gear means mounted on said door means for movement with the door means about said hinge pin; second gear means movably mounted on said cabinet structure and operatively engageable with said first gear means; and biasing means for preloading said second gear means to a predetermined position for yieldingly restraining said first and second gear means to prevent movement of said door means beyond said horizontally extending open position with less than a predetermined loading on said door means, said first gear means being operable responsive to a loading on said door means exceeding said predetermined loading for overcoming the preloaded biasing of said second gear means and effecting controlled movement of said door means to an overload position at which a portion of said door means engages said horizontal surface.

2. In a front opening appliance as defined in claim **1** wherein said door means and said first gear means is freely movable from said closed position to said open position and wherein said first gear means is engageable with said preloaded second gear means at said open position for effectively locating said door means in said open position.

3. In a front opening appliance as defined in claim **1** wherein said second gear means is mounted on a pivot pin supported by said cabinet structure and wherein said biasing means is in the form of a spring member operable as an over-center spring to preload said second gear means and resist movement of said second gear means in a first direction while oriented on one side of said pivot pin and operable for biasing said second gear means in said first direction to effectively retain said door means in said overload position after the spring passes over the pivot pin responsive to movement of said door means to said overload position.

4. In a front opening appliance including a cabinet structure having an access opening on one generally vertical side; door means operable relative to said cabinet between a closed position covering said access opening, a normal open position, and an overload position; hinge means juxtaposed the lower portion of said door means for movably supporting said door means on

said cabinet structure; and first biasing means connected between said cabinet structure and said door means for at least partially compensating for the weight of said door means as said door means is moved from said closed position, wherein the improvement comprises: door movement control means for controlling movement of said door means relative to said cabinet structure and including a first member in the form of an arm mounted on said door means for movement therewith and for movement relative to said cabinet structure, a second member movably mounted on said cabinet structure, stop means mounted on said cabinet structure for engagement with said second member to locate said second member at a predetermined position; and second biasing means for biasing said second member into engagement with said stop means, said second member in said predetermined position being connectable with said first member only upon movement of said door means to said open position from said closed position whereby movement of said door means from said closed position to said open position is independent of said second biasing means, said first member and said second member being cooperable with said second biasing means at said open position to yieldably locate said door means in said open position with less than a predetermined loading thereon, said door movement control means being operable for effecting an operative connection of said second biasing means to said door means for biasingly resisting movement of said door means toward said overload position with greater than said predetermined loading thereon.

5. In a front opening appliance as defined in claim **4** wherein said first member includes a gear segment adjacent one end thereof and wherein said second member includes a gear portion initially engageable with the gear segment of said first member at said predetermined position to effectively locate said door means in said open position and operable as mating gears during movement of said door means from said open to said overload position.

6. In a front opening appliance as defined in claim **4** wherein said first member is mounted on said door means for movement therewith, said second member is pivotally mounted on said cabinet structure, and wherein said door movement control means further includes an intermediate linkage means operatively connecting said first and second members at said predetermined position to effectively locate said door means in said open position.

7. In a front opening appliance as defined in claim **4** wherein said second biasing means is further operable for yieldably maintaining said door means in said overload position.

8. In a front opening appliance as defined in claim **7** wherein said second biasing means is in the form of an over-center spring operable in the overload position of said door means for applying a generally opposite force to said second member for yieldably maintaining said door means in said overload position and wherein said door means is manually operable from said overload position to said open position for resetting said first and second members to their respective positions corresponding to the open position of said door means for further control of said door means.

9. In a front opening appliance including a cabinet structure supportable juxtaposed a substantially horizontal surface and having an access opening on one side; door means normally operable between a closed position covering said access opening and a substantially horizontal open position spaced above said horizontal surface; hinge means for movably supporting said door means on said cabinet structure; and first biasing means operative between said cabinet structure and said door means at least partially compensating for the weight of said door means as said door means is moved from said closed position, wherein the improvement comprises: a first member in the form of an arm mounted on said door means for movement therewith and for movement relative to said cabinet structure; a second member movably mounted on said cabinet structure; stop means mounted on said cabinet structure for engagement with said second member to locate said second member at a predetermined position; and second biasing means for biasing said second member into a preloaded engagement with said stop means, said second member in said predetermined position being engageable with said first member only upon movement of said door means to said open position from said closed position whereby movement of said door means from said closed position to said open position is independent of said second biasing means, said first member and said second member being operable at said open position for connecting said second biasing means to said door means to locate said door means in said open position and to effectively prevent movement of said door means beyond said substantially horizontal open position with less than a predetermined loading thereon, said second member being movable from said predetermined position in cooperation with said first member responsive to loading on said door means exceeding said predetermined loading for maintaining the connection of said second biasing means to said door means during at least a portion of the movement of said door means between said open position and an overload position for applying a force to said door means in a direction opposing movement of said door means toward said overload position and assisting in the return of said door means toward said open position and thereby effecting controlled movement of said door means between said open position and said overload position at which a portion of said door means engages said horizontal surface.

10. In a front opening appliance as defined in claim **9** wherein said second biasing means is in the form of an over-center spring connected between said second member and said cabinet structure and operable for resisting movement of said door means from said open position to said overload position and further operable for yieldably maintaining said door means in said overload position upon movement of said door means to the overload position.

11. In a front opening appliance including a cabinet structure having an access opening on one generally vertical side; door means operable relative to said cabinet structure between a closed position covering said access opening, a normal open position, and an overload position; and hinge means juxtaposed the lower portion of said door means for movably supporting said door means on said cabinet structure, wherein the improvement comprises: door movement control means for controlling movement of said door means relative to said cabinet structure to locate said door means in said open position with less than a predetermined load-

ing thereon and to control movement of said door means toward said overload ns position with greater than said predetermined loading thereon, said door movement control means including a first member mounted on said door means for movement therewith, a second member movably mounted on said cabinet structure, stop means on said cabinet structure for engagement with said second member to locate said second member for engagement with said first member at the open position of said door means, and biasing means for biasing said second member into engagement with said stop means, said biasing means comprising an over-center spring connected between said cabinet structure and said second member for operative connection to said door means through said first and second members at said open position of said door means, said over-center spring having a preloaded condition to effectively locate said door means in said open position and operable for resisting movement of said door means from said open position toward said overload position, said over-center spring being movable relative to said cabinet structure as said door means moves toward said overload position and operative in said overload position for biasing said second member away from said stop means to yieldably maintain said door means in said overload position.

12. In a front opening appliance including a cabinet structure having an access opening on one generally vertical side; door means operable between a closed position covering said access opening and an open position extending generally outwardly from said cabinet structure; and hinge means juxtaposed the lower portion of said door means for pivotally supporting said door means on said cabinet structure, wherein the improvement comprises: a first door movement control member mounted on said door means; a second door movement control member movably mounted on said cabinet structure; stop means mounted on said cabinet structure for engagement with said second member to locate said second member at a predetermined position; means for effecting operative interconnection of said first member and said second member at said open position; and biasing means in the form of an over-center spring connected between said cabinet structure and said second member and in a first posture being operable on said second member to preload said second member into engagement with said stop member, said first and second members, said interconnection means and said biasing means being cooperable to resist movement of said door means from said open position toward said overload position for yieldably maintaining said door means in said open position with less than a predeterminded loading thereon and being responsive to a predetermined overload on said door means in said open position for effecting controlled movement of said door means from said open position to an overload position, said biasing means being movable to a second posture upon movement of said door means to said overload position and operable in said second posture for applying a generally opposite force to said second member to yieldably maintain said door means in said overload position, said door means being manually movable from said overload position toward said open position for resetting said first and second members and said interconnection means to positions corresponding to the open position of said door means.

13. In a front opening appliance including a cabinet structure having an access opening on one generally vertical side; door means operable relative to said cabinet between a closed position covering said access opening, a normal open position, and an overload position; hinge means juxtaposed the lower portion of said door means for movably supporting said door means on said cabinet structure; and first biasing means operative between said cabinet structure and said door means at least partially compensating for weight of said door means as door means is moved from said closed position, wherein the improvement comprises: door movement control means for controlling movement of said door means relative to said cabinet structure and including a first member mounted on said door means for movement therewith, a second member movably mounted on said cabinet structure, stop means on said cabinet structure for engagement with said second member to locate said second member for engagement with said first member at the open position of said door means, and second biasing means for biasing said second member into engagement with said stop means, said door movement control means being operable to locate said door means in said open position with less than a predetermined loading thereon and to control movement of said door means during movement of said door means from said open position toward said overload position with greater than said predetermined loading thereon, said preloaded second biasing means being operable during at least a portion of the movement of said door means from said open position toward said overload position for resisting continued movement of said door means with an opposing force at least as great as the force resisting movement from the open position.

14. In a front opening appliance including a cabinet structure having an access opening on one generally vertical side; door means movable relative to said cabinet structure between a closed position covering said access opening, a normal open position, and an overload position; and hinge means juxtaposed the lower portion of said door means for movably supporting said door means on said cabinet structure, wherein the improvement comprises: door movement control means for controlling movement of said door means relative to said cabinet structure, said door movement control means including a first member mounted on said door means, a second member pivotally mounted on said cabinet structure, stop means mounted on said cabinet structure for engagement with said second member to locate said second member at a predetermined position, biasing means for biasing said second member into engagement with said stop means, and means comprising a cable for operatively connecting said first member to said second member upon movement of said door means to the open position from said closed position whereby said biasing means becomes initially connected to said door means at the open position of said door means, said door movement control means being operable to yieldably locate said door means in said open position with less than a predetermined loading thereon and being operable through the cable connection for directly resisting movement of said door means from said open position toward said overload position with greater than said predetermined loading thereon.

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