Sept. 9, 1969 L. W. GUTH 3,466,108

DOOR-OPERATED RACK EXTENDING AND RETRACTING MEANS FOR A FRONT-OPENING APPLIANCE CABINET

Filed Dec. 21, 1967 3 Sheets-Sheet 1

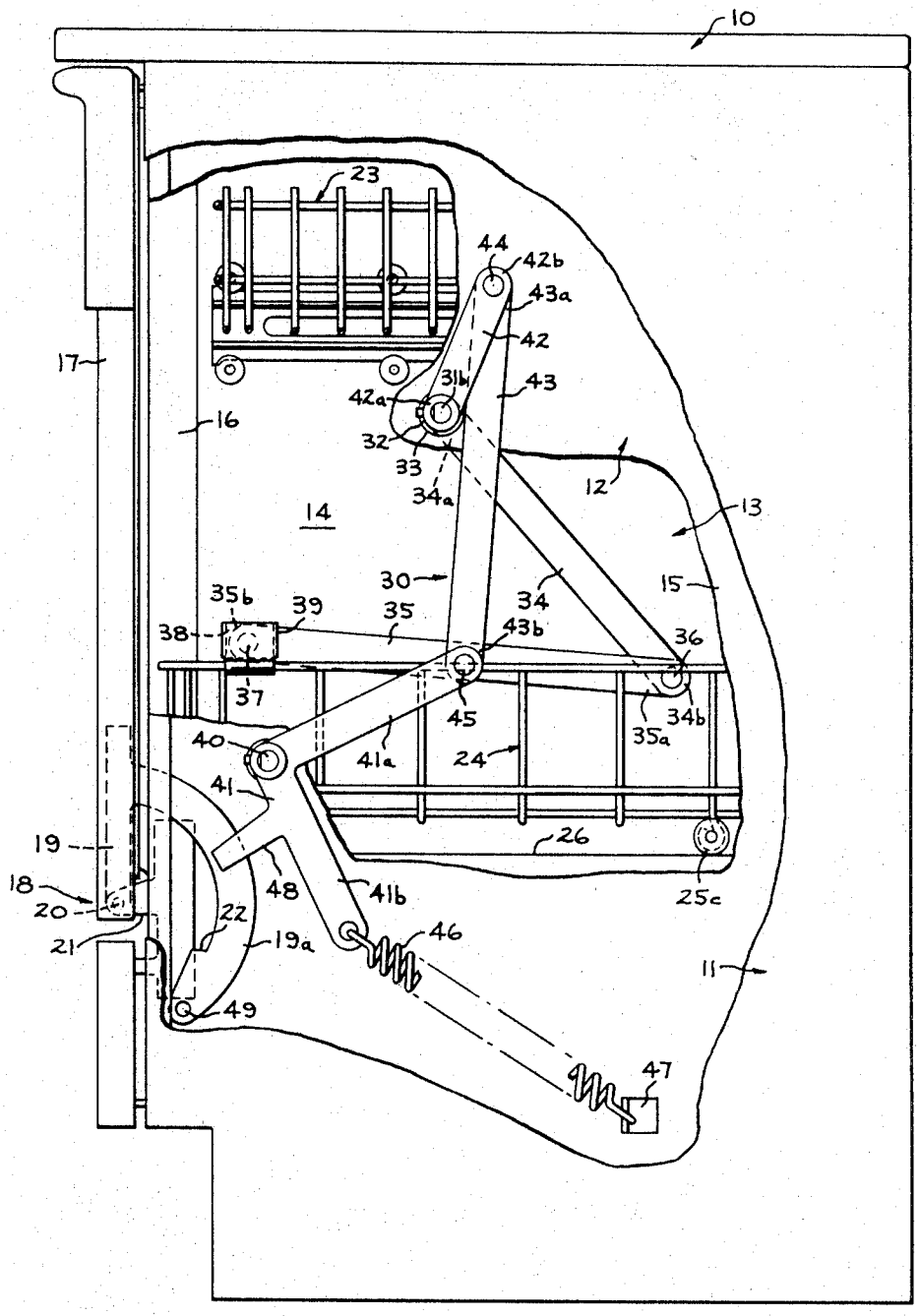



FIG. 1

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FIG. 2

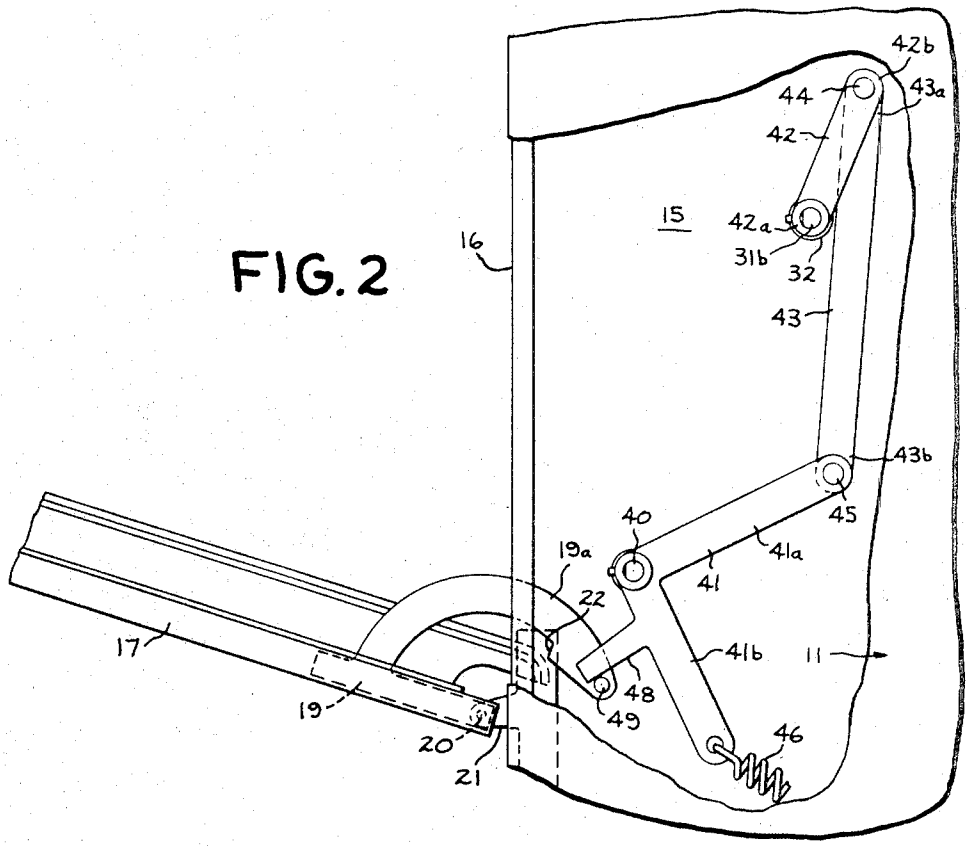
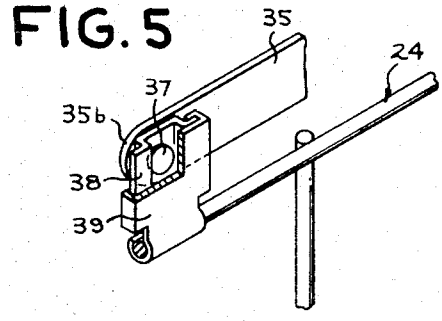



FIG. 5




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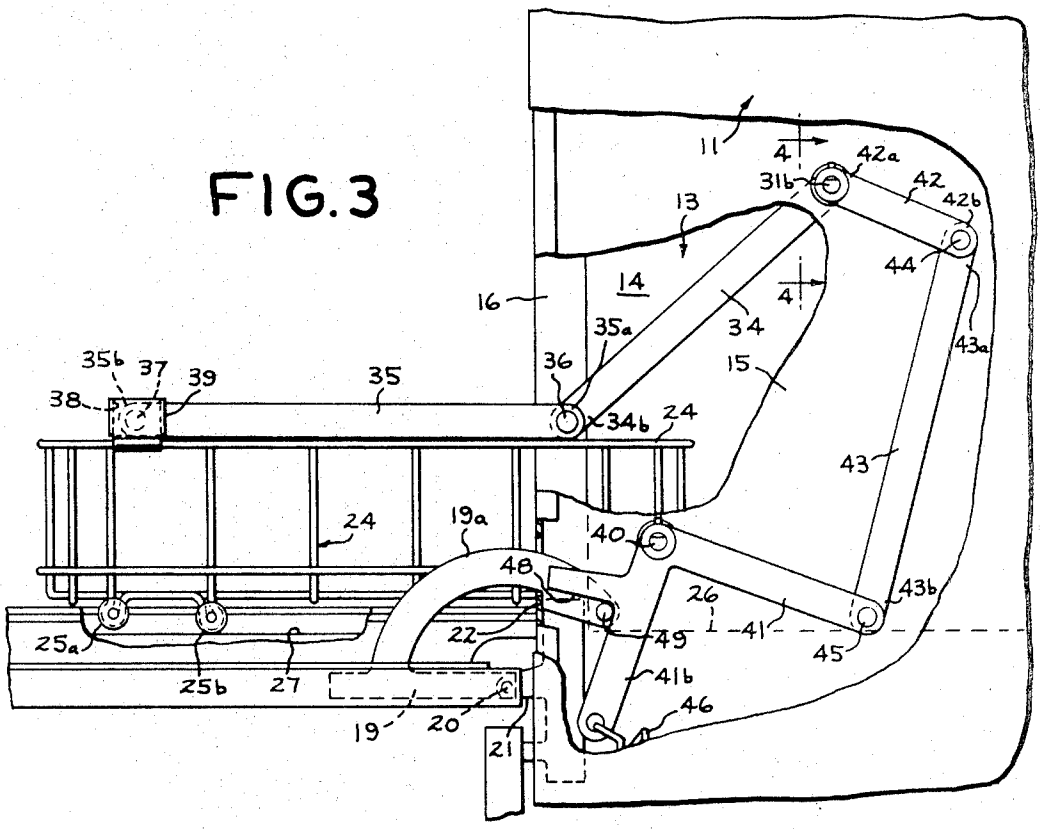
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DOOR-OPERATED RACK EXTENDING AND RETRACTING MEANS FOR A FRONT-OPENING APPLIANCE CABINET

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FIG. 3



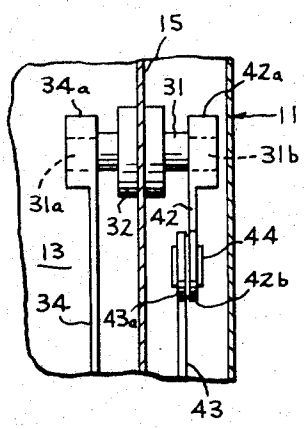




FIG. 4

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3,466,108

# DOOR-OPERATED RACK EXTENDING AND RETRACTING MEANS FOR A FRONT-OPENING APPLIANCE CABINET

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Int. Cl. A47l 15/50; A47b 77/08
U.S. Cl. 312—274 8 Claims

## ABSTRACT OF THE DISCLOSURE

Door-operated means for extending or retracting an article-receiving rack of an appliance, such as a dishwasher or the like, of the front-opening horizontally-hinged drop-door type. The appliance includes a cabinet structure forming an enclosure having a front wall provided with an access opening and a door for the opening hinged for pivotal movement between a non-horizontal or generally vertical fully-closed position and a substantially horizontal fully-open position. An article-receiving rack is supported within the enclosure for movement through the access opening on first track means within the enclosure and on second track means on the door inner surface, which are horizontally aligned when the door is in its fully open position. Linkage means are pivotally mounted on one of the cabinet structure walls for connection with the movable rack. The linkage means are operable, when actuated, to propel a major portion of the rack along the track means and through the enclosure access opening in a fore-and-aft direction. Means carried by the door for hinged pivotal movement therewith are provided for engaging and actuating the linkage means during only the final few degrees of door opening and the initial few degrees of door closing movements, whereby the linkage means are engaged with and operated by the door only when the enclosure and door track means are generally horizontally aligned.

## BACKGROUND OF THE INVENTION

### Field of the invention

The present invention relates generally to appliances and more particularly to door-operated means for extending and retracting an article-receiving rack of a dishwasher of the front-opening drop-door type.

Dishwashing machines often include a cabinet structure forming a washing enclosure having an access opening through the front side wall thereof. The access opening is usually provided with a door hinged at its bottom edge for pivotal movement from a vertical to a horizontal position to permit access to the washing enclosure. In such machines, rack means are provided for supporting articles to be washed within the washing enclosure. These rack means commonly included an open framework rack supported on rollers that rest on tracks on the enclosure side walls at the lower portion of the enclosure. The door is also provided with tracks which align with the enclosure tracks when the door is in its horizontal or fully opened position, and the rack is manually rolled along the enclosure and door tracks to position the same over the open door to facilitate loading of the rack. Following loading, the rack must be manually rolled on the door and enclosure tracks to a retracted position wholly within the enclosure and the door, then closed by an additional subsequent manual operation. Hence it would be desirable if the door and the rack could be connected so that manual opening and closing of the door would simultaneously respectively result in automatic extension and retraction of the rack, whereby the conventionally required additional manual operations of the rack could be eliminated.



### Description of the prior art

U.S. Patents Nos. 3,058,479 and 3,248,158 disclose door-operated means for extending an article-receiving rack of a dishwasher of the front-opening drop-door type. However, these prior-art means operate to extend only a small fraction of the rack onto the open door and the dishwasher operator is still required to manually further extend the rack in order to conveniently load the same.

## SUMMARY OF THE INVENTION

The present invention provides improved door-operated means for extending and retracting an article-receiving rack of an appliance, such as a dishwasher or the like, of the front-opening horizontally-hinged drop-door type, wherein the rack is supported for movement through the access opening on first track means within the enclosure and on second track means on the door, which are horizontally aligned when the door is in its fully open position. In accordance with the present invention, linkage means are pivotally mounted on a wall of the enclosure for connection with the movable rack. The linkage means are operable when actuated, to propel a major portion of the rack along the track means and through the enclosure opening in a fore-and-aft direction. Means carried by the door for hinged pivotal movement therewith are provided for engaging and actuating the linkage means during only the final few degrees of opening or the initial few degrees of closing movements of the door, whereby the linkage means are engaged with and operated by the door only when the enclosure and door track means are generally horizontally aligned.

## BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a right side elevational view, with parts broken away to illustrate details, of an automatic dishwasher incorporating the present invention, with the washing enclosure access opening door shown in its generally vertical or fully closed position;

FIGURE 2 is a fragmentary view similar to FIGURE 1, showing the condition of a door-operated rack extending and retracting means as the door approaches its final few degrees of opening movement or completion of its initial few degrees of closing movement;

FIGURE 3 is a view similar to FIGURE 2, but showing the condition of the rack extending and retracting means with the door in its horizontal or fully open position;

FIGURE 4 is a fragmentary sectional view taken along lines 4—4 of FIGURE 3; and

FIGURE 5 is a fragmentary elevational perspective view, partly in section, showing details of the means for readily connecting and disconnecting the door-operated extending and retracting linkage means to and from the lower rack.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and particularly to FIGURE 1 thereof, there is illustrated an automatic dishwasher **10** having a cabinet structure including an outer cabinet **11** and an inner cabinet **12**. It should be noted at the outset, that the present invention is not liimted in its application to a dishwasher, but may be employed with any appliance cabinet structure. The application of the invention in a dishwasher is for purposes of illustration only.

A washing enclosure **13** is defined within the inner cabinet **12** which includes left and right side walls **14** and **15**. The outer and inner cabinets **11** and **12** are constructed

with flanged registering front wall openings mated together to provide an access opening **16** to the washing enclosure **13** so that articles may be placed therein or removed therefrom.

A door **17** is provided for the access opening **16** and is hinged about its bottom edge by hinge means **18** so as to pivot about a horizontal axis between a non-horizontal or generally vertical fully-closed position (FIGURE 1) and a substantially horizontal fully-open position (FIGURE 3).

The hinge means **18** comprise two hinge mechanisms that are respectively provided at adjacent left and right sides of the bottom of the door **17**. While only the right hinge mechanism is shown in the drawing, it should be understood that the left is generally similar in structure. Each of the left and right hinge mechanisms includes a door-mounted hinge member **19** that is hinged by a horizontally-arranged pin **20** to a stationary hinge member **21** that protrudes from the front of the cabinet structure beneath the access opening **16**. Each door-mounted hinge member **19** is formed with a generally arcuately-shaped hinge arm **19***a* which has a distal end that projects rearwardly and downwardly into the space between the outer and inner cabinets **11** and **12** through an aperture provided in the access opening flange. The distal end of each hinge arm **19***a* is provided with a stop surface **22** which engages the rear face of the inner cabinet access opening flange as the door **17** reaches its fully open position (FIGURE 3).

A pair of vertically spaced open framework racks **23** and **24** are provided within the washing enclosure **13**. Each of the racks **23** and **24** is formed from wire rods in a conventional manner so as to receive, in a suitable position for washing, a varied assortment of articles, such as dishes, glassware and the like (not shown). Also, each of the racks **23** and **24** is mounted so as to move generally horizontally forward or outward (to the left as seen in FIGURES 1–3) when the door **17** is open, so that racks are made accessible for loading and unloading purposes.

The support system for giving this mobility to the upper rack **23** may be of any conventional design. For example, the upper rack **23** may be provided with a slide-out mechanism (not specifically shown), such as described and claimed by Norman L. Kendt in U.S. Patent 3,096,125 issued July 2, 1963, and assigned to the General Electric Company, assignee of the present invention. Since the exact slide mechanism provided for the upper rack **23** is not critical to the present invention, it is not described in detail herein.

The lower rack **24** has a horizontal cross-sectional area substantially equal to that of the enclosure **13** and is provided with a series of roller sets **25***a*, **25***b*, and **25***c* on the left and right edges of its bottom. When the lower rack **24** is positioned wholly within the enclosure **13** in its fully retracted position, the roller sets **25***b* and **25***c* rest upon parallel horizontal surfaces or tracks **26** provided on the interior of the enclosure side walls **14** and **15**. The enclosure tracks **26** extend forwardly from the rear of the enclosure and terminate adjacent the access opening **16**. As best shown in FIGURE 3, other tracks **27** are provided on the inner face of the door **17** which, when the door **17** is pivoted to its fully open position, are aligned with the enclosure tracks **26** to permit a major portion of the lower rack **24** to be rolled generally horizontally onto the open door **17**.

As previously indicated, the present invention is particularly concerned with providing mean operable by the manual opening and closing of the door **17** to respectively simultaneously automatically perform the extension and retraction of the lower rack **24** from and into the enclosure **13**, whereby the convention additionally required manual operations for the extending and retracting thereof can be eliminated. As described in detail hereinafter, the present invention provides such door-operated means and further provides that they are operable during only the final few degrees of the opening and the initial few degrees of the closing movement of the door **17** about the hinge pins **20**, when the enclosure and door tracks **26** and **27** are generally horizontally aligned, whereby undesirable cocking of the track **24** is avoided during its extension or retraction through the enclosure access opening **16** by the door-operated means of the present invention.

In accordance with the form of the present invention illustrated in the figures, linkage means, generally indicated at **30**, are pivotally mounted on the enclosure right side wall **15**, which can connect the door **17** to the lower rack **24** and can be respectively operated by downward movement of the door **17** about the hinge pins **20** to simultaneously extend a major portion of the rack **24** onto the door **17** and by upward movement of the door **17** about the hinge pins **20** to simultaneously retract the rack **24** wholly within the enclosure **13**.

As illustrated, the linkage means **30** include a horizontally-arranged first axle **31**, which is rotatably journaled in a bearing **32** that is suitably mounted in an opening **33** in the enclosure right side wall **15** at a point above the enclosure tracks **26** and rearward of the access opening **16**. Of course, suitable sealing means (not shown) are provided to prevent the escape of wash fluid through the spaces between the opening **33** and bearing **32** and the axle **31** and bearing **32**. As best shown in FIGURE 4, the first axle **31** has an inner end **31***a* that extends within the enclosure **13** and an outer end **31***b* that extends outside the enclosure **13**. A first link **34** is provided and has one of its two opposite ends **34***a* secured to the inner end **31***a* of the axle **31** for pivotal movement therewith. A second link **35** has one of its two opposite ends **35***a* pivotally mounted to the other end **34***b* of the first link **34** by horizontally arranged pin **36**.

As shown in detail in FIGURE 5, the other end **35***b* of the second link **35** is pivotally mounted by another horizontally-arranged pin **37** to a generally channel-shaped member **38**, which is slidably received within a complementary-shaped bracket **39** that is fixed on and projects vertically upward from the lower rack **24** at a point adjacent the right upper front edge of the rack **24**. The lower rack **24** can be readily disconnected from the linkage means **30** for complete manual removal from the dishwasher **10** by sliding the member **38** upwardly out of the bracket **39**.

A horizontally-arranged second axle **40** is fixed on the outside of the enclosure right side wall **15** at a point below and forward of the first axle **31**. A bell-crank lever **41** is provided and is pivoted adjacent the junction of its two arms **41***a* and **41***b* on the fixed second axle **40**. A third link **42** is provided and has one of its two opposite ends **42***a* secured to the outer end **31***b* of the first axle **31** for pivotal movement therewith. A fourth link **43** has one of its two opposite ends **43***a* pivotally mounted to the other end **42***b* of the third link **42** by yet another horizontally-arranged pin **44**. The other end **43***b* of the fourth link **43** is pivotally mounted by still another horizontally-arranged pin **45** to the free end of the upper one of the bell-crank arms **41***a*.

Yieldable means comprising a tension spring **46** is connected between the free end of the lower arm **41***b* of the bell-crank lever **41** and a bracket **47** that is secured to the base of the cabinet structure. The spring **46** biases the bell-crank lever **41** to pivot about the fixed second axle **40** in a direction (counter-clockwise as seen in FIGURES 1–3) to yieldably urge the linkage means **30** to operate to move the lower rack **24** toward the rear of the enclosure **13**.

The lower arm **41***b* of the bell-crank lever **41** is provided with a cam surface **48** which is adapted to be engaged by a cam-following actuator member or pin **49** that is mounted on the right door hinge arm **19***a*. The cam-following actuator member **49** is adapted to be slidably engaged with and moved along the cam surface **48** by downward pivotal movement of the door **17** about the

hinge pins **20**, to thereby pivot the bell-crank lever **41** in a direction (clockwise as seen in FIGURES 1–3) opposite that urged by the spring **46** and thus, actuate the linkage means **30** to operate to propel the lower rack **24** away from the rear of the enclosure **13**.

The bell-crank lever **41** and the links **34**, **35**, **42** and **43** are sized and arranged in such a manner that pivotal movement of the lever **41** about the fixed second axle **40** will cause the rack **24** to be moved generally horizontally along the enclosure and door tracks **26** and **27** and through the access opening **16** in a fore-and-aft direction.

Undesirable cocking of the lower rack **24** during its generally horizontal extension and retraction by the linkage means **30** through the access opening **16** is avoided by so arranging the cam-following actuator member **49** on the door hinge arm **19***a* and the cam surface **48** on the lower lever arm **41***b* that the engagement of the actuator member **49** and the cam surface **48** is limited to the final few degrees of the opening and the initial few degrees of the closing movements of the door **17**. As illustrated in FIGURES 1–3, the cam-following actuator member **49** is slidably engaged with the cam surface **48** and outward or inward propulsion of the lower rack **24** through the opening **16** respectively commences or ends when the door **17** is within a few degrees, for example 17°, of the horizontal plane. Furthermore, as shown in FIGURE 3, the front set of rollers **25***a* are journaled on the lower rack **24** at a slightly higher elevation than the roller sets **27***b* and **27***c*, whereby they can be rollingly engaged with and guided by the door tracks **27** when the door **17** is slightly above the horizontal plane, and, thus, further function to avoid undesirable cocking of the lower rack **24**.

Assuming that the lower rack **24** has been connected with the linkage means **30** by slidable insertion of the member **38** into the rack-fixed bracket **39**, as shown in FIGURES 1, 3 and 5, and that the door **17** is in its fully-closed position (FIGURE 1), the form of the present invention illustrated in the figures preferably operates in the following manner. The dishwasher operator manually pivots the door **17** downwardly about the hinge pins **20** towards its fully-open position (FIGURE 3). The lower rack **24** will remain in its retracted position wholly within the enclosure **13**, until the door **17** is within a few degrees of the horizontal plane and the enclosure and door tracks **26** and **27** are generally horizontally aligned with one another (FIGURE 2), whereupon the cam-following actuator member **49** will slidably engage the cam surface **48** on the lower arm **41***b* of the bell-crank lever **41**. Once the cam-following actuator member **49** engages the cam surface **48**, continued downward movement of the door **17** about the hinge pins **20** (FIGURE 3) slides the follower member **49** along the cam surface **48** causing the bell-crank lever **41** to pivot about the fixed second axle **40** (clockwise as seen in FIGURES 1–3). This, in turn, causes the links **34**, **35**, **42** and **43** and the first axle **31** to pivot in such a manner to operate to propel a major portion of the lower rack **24** generally horizontally outwardly or forwardly through the access opening **16** (to the left as seen in FIGURES 1–3), rolling the rack roller sets **25***a–c* along the generally horizontally aligned enclosure and door tracks **26** and **27** to extend a major portion of the lower rack **24** over the top of the open door **17**. Of course, downward movement of the door **17** is stopped by engagement of hinge arm stop surfaces **22** against the rear face of the access opening flange as the door **17** reaches the fully open or horizontal position (FIGURE 3). The door **17** will be retained in its fully open position and the rack **24** in its extended position by the combined weights of the door **17** and the extended portion of rack **24**, which are made sufficient to overcome the return force of the spring **46**, which, as previously explained, biases linkage means **30** to operate to move the rack **24** towards its retracted position within the enclosure **13**.

The lower rack **24** can now be retracted wholly within the enclosure **13** by a single manual operation of pivoting the door **17** upward about the hinge pins **20**. This upward movement of the door **17** is of course assisted by the spring **46**. The initial few degrees of this upward manual movement of the door **17** cause the cam-following actuator member **49** to slide along the cam surface **48** and pivot the bell-crank lever **41** about the fixed axle **40** (counter-clockwise as seen in FIGURES 1–3) which, in turn, causes the links **34**, **35**, **42** and **43** and the first axle **31** to pivot in such a manner to operate to propel the lower rack **24** generally horizontally inwardly or rearwardly through the access opening (to the right as seen in FIGURES 1–3) to a retracted position wholly within the enclosure (FIGURES 1 and 2), when the enclosure and door tracks **26** and **27** are generally horizontally aligned with one another. This pivotal movement of the bellcrank lever **41** is, of course, assisted by the tension spring **46**.

Thus it can be seen that the present invention provides improved means for extending and retracting the article-receiving rack of an appliance, such as a dishwasher or the like, of the type including a cabinet of the front-opening horizontally-hinged drop-door type, which are operable by manual opening and closing of the door to respectively simultaneously automatically extend and retract a major portion of the rack generally horizontally through the cabinet opening, whereby the conventionally required attitional manual operations for extending and retracting the rack can be eliminated.

As will be evident from the foregoing description, certain aspects of the present invention are not limited to the particular details of construction of the form illustrated, and it is contemplated that various other modifications or applications may occur to those illustrated. For example, while the present invention is illustrated as being installed only at the enclosure right side wall **15**, it obviously can be installed at the left side wall **14** or installed in duplicate at both side walls **14** and **15**. Furthermore, the cam surface **48** can be modified so that the spring **46** can be omitted. Also, the cam surface **48** can be modified such that the linkage means **30** are engaged and actuated by the door-carried cam-following actuator member **49** during only the final few degrees of the door opening movement, whereby the door-operated means of the present invention can operate only to extend the lower rack **24**, but not to retract it.

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

**1.** In an appliance, such as a dishwasher or the like, of the type including a cabinet structure forming an enclosure having a wall provided with an access opening and a door for the opening hinged for pivotal movement between a non-horizontal fully closed position and a substantially horizontal fully open position, and an article-receiving rack supported for movement through the opening on first track means within the enclosure and on second track means on the door, which are horizontally aligned when the door is in its fully open position, door-operated means for respectively simultaneously extending a major portion of the rack through the opening upon opening of the door and retracting the rack wholly within the enclosure upon closing of the door, comprising:

(a) linkage means pivotally mounted on a wall of the cabinet structure for connection with the rack and operable, when actuated, to propel a major portion of the rack along the track means and through the access opening; and

(b) actuator means mounted on the door for hinged pivotal movement therewith for engaging and actuating said linkage means during only the final degrees of the opening and initial degrees of the closing movements of the door when the enclosure and door track means are generally horizontally aligned.

**2.** The invention of claim **1**, further including yieldable means connected between the cabinet structure and

said linkage means for yieldably urging said linkage means to move the rack inwardly through the opening.

3. The invention of claim 1, further including means for readily connecting and disconnecting the rack to and from said linkage means, whereby the rack can be readily completely removed from the appliance.

4. The invention of claim 1, wherein said linkage means comprises:

(a) a first axle rotatably journaled in a wall of the enclosure and having an inner end inside the enclosure and an outer end outside the enclosure;

(b) a first link having one of its opposite ends mounted on said inner end of said axle for movement therewith;

(c) a second link having one of its opposite ends pivotally connected to the other end of said first link and having its own other end pivotally mounted to means connectable with the rack;

(d) a second axle fixed on the cabinet structure outside of said enclosure;

(e) a bell-crank lever pivoted adjacent the junction of its two arms on said second axle;

(f) a third link having one of its opposite ends mounted on said outer end of said first axle for movement therewith;

(g) a fourth link having one of its opposite ends pivotally mounted to the other end of said third link and having its own other end pivotally mounted to one of said crank arms; and

(h) cam means on the other of said crank arms pivotally movable with said crank about said second axle;

(i) said cam means being engageable with said actutor means for movement thereby during only the final degrees of the opening and initial degrees of the closing movements of the door when the enclosure and door track means are generally horizontally aligned.

5. The invention of claim 4, further including a tension spring connected between the cabinet structure and said other of said crank arms for biasing said crank towards pivotal movement about said second axis in a direction to operate said links to move the rack inwardly through said opening.

6. In an appliance, such as a dishwasher or the like, of the type including a cabinet structure forming an enclosure having a wall provided with an access opening and a door for the opening hinged for pivotal movement between a non-horizontal fully closed position and a substantially horizontal fully open position, and an article-receiving rack supported for movement through the opening on first track means within the enclosure and on second track means on the door, which are horizontally aligned when the door is in its fully open position, door-operated means for simultaneously extending a major portion of the rack outwardly through the opening upon opening of the door, comprising:

(a) linkage means pivotally mounted on a wall of the cabinet structure for connection with the rack and operable, when actuated, to propel a major portion of the rack along the track means and through the access opening; and

(b) actuator means mounted on the door for hinged pivotal movement therewith for engaging and actuating said linkage means during only the final degrees of the opening movements of the door when the enclosure and door track means are generally horizontally aligned.

7. The invention of claim 6, further including means for readily connecting and disconnecting the rack to and from said linkage means, whereby the rack can be readily completely removed from the appliance.

8. The invention of claim 6, wherein said linkage means comprises:

(a) a first axle rotatably journaled in a wall of the enclosure and having an inner end inside the enclosure and an outer end outside the enclosure;

(b) a first link having one of its opposite ends mounted on said inner end of said axle for movement therewith;

(c) a second link having one of its opposite ends pivotally connected to the other end of said first link and having its own other end pivotally mounted to means connectable with the rack;

(d) a second axle fixed on the cabinet structure outside of said enclosure;

(e) a bell-crank lever pivoted adjacent the junction of its two arms on said second axle;

(f) a third link having one of its opposite ends mounted on said outer end of said first axle for movement therewith;

(g) a fourth link having one of its opposite ends pivotally mounted to the other end of said third link and having its own other end pivotally mounted to one of said crank arms; and

(h) cam means on the other of said crank arms pivotally movable with said crank about said second axle;

(i) said cam means being engageable with said actuator means for movement thereby during only the final degrees of closing movements of the door when the enclosure and track means are generally horizontally aligned.


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JAMES T. McCALL, Primary Examiner

U.S. Cl. X.R.

126—340; 312—24, 311