Sept. 26, 1961 O. L. LONG ET AL 3,001,227

DISHWASHING APPARATUS

Filed July 16, 1959

FIG. 1.

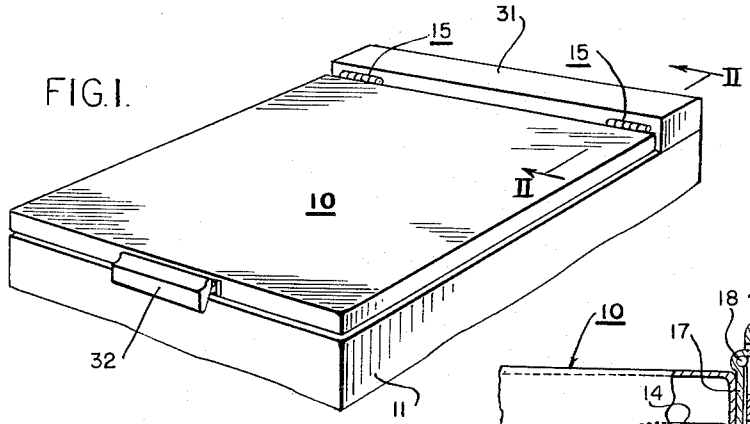


FIG. 2.

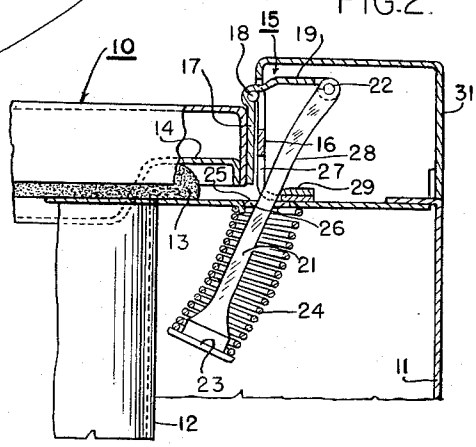


FIG. 3.

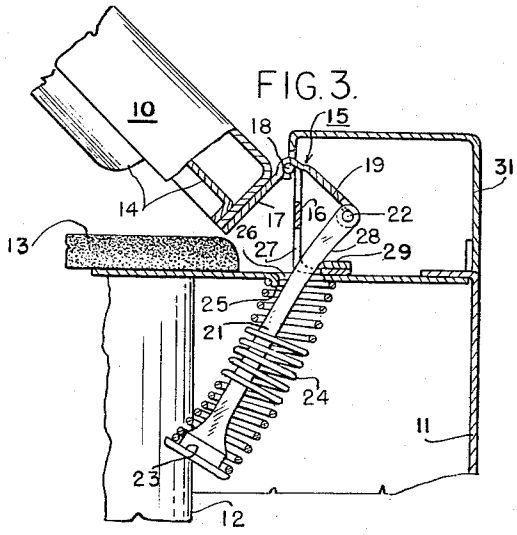
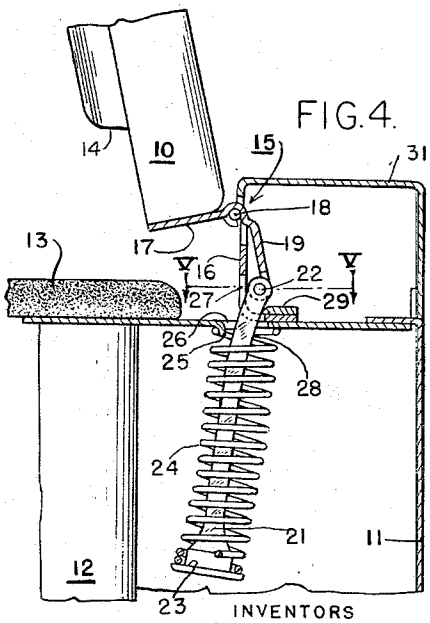


FIG. 4.



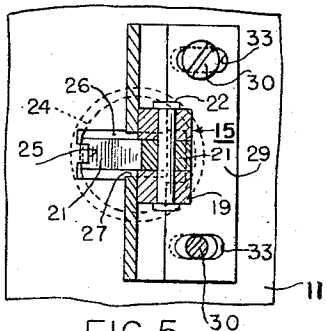


FIG. 5.

INVENTORS
OLAN L. LONG
HAL H. DRONBERGER

BY Raymond & Ridge

ATTORNEY

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DISHWASHING APPARATUS

Olan L. Long, Hilliard, and Hal H. Dronberger, Columbus, Ohio, assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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3 Claims. (Cl. 16—190)

This invention relates to a counterbalancing mechanism for a hinged dishwasher lid or the like, movable from a generally horizontal position toward the vertical, and it has for an object to provide an improved mechanism of this kind.

Another object of the invention is to provide a simple, inexpensive mechanism of the type set forth that is effective to balance the force due to the weight of the lid and which varies non-linearly throughout the range of movement of the lid.

A further object of the invention is to provide an improved counterbalance utilizing a conventional spring, whose bias varies linearly, for opposing the gravitational forces in a hinged lid of the class set forth, which forces vary non-linearly as the lid is moved to various positions.

In practising the invention, as applied to a hinged dishwasher lid movable from a closed horizontal position to a generally vertical open position, an arm movable with the lid angularly about the hinge is provided. A tension rod is pivoted at one end to the arm and the lower end of the rod passes through a helical compression spring and bears against the free end thereof. The other or fixed end of the spring abuts against a stationary portion of the dishwasher casing structure. During movement of the lid between its horizontal closed position and its generally vertical position, the moment due to gravity about the hinge is non-linear while the change in bias of the spring is linear. Compensation for this condition is provided by a fixed bearing plate or fulcrum which engages an intermediate portion of the tension rod and effects a change in the angular relation between the rod and the arm when the lid is about half open. The spring whose bias has been greatly reduced at this point is, therefore, assisted in balancing the lid between this half-open position and the vertical open position thereof. It will be understood, that, between the closed horizontal position of the lid and said half-open position thereof, the compressed spring has sufficient biasing force to adequately counterbalance the lid.

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 illustration of a dishwasher lid counterbalanced in accordance with the invention;

FIG. 2 is a section taken along the line II—II of FIG. 1;

FIGS. 3 and 4 are views similar to FIG. 2, with the apparatus in different positions; and

FIG. 5 is an enlarged section taken along the line V—V of FIG. 4.

Referring to FIG. 1, the invention is shown applied to a movable lid **10** of a top opening dishwasher, the casing of which is shown in part at **11**. Arranged within the casing is a conventional open top tub structure **12** (see FIG. 2) having an upstanding soft gasket **13** arranged peripherally on the open top thereof. The lid **10** may include an inner pan structure **14** which bears on the gasket **13** in the closed position of the lid as is understood. The lid **10** is carried by a pair of hinge stuctures **15** of similar construction and each including

a fixed portion **16** and a swinging leaf **17** fixed to the lid in any suitable manner and pivoted by means of a pin **18** to the fixed portion **16**.

In accordance with this invention, an arm **19** movable with the lid **10** angularly about the pin **18** is provided and this arm **19** is preferably integral with the hinge leaf **17**. This arm **19** is a part of the counterbalancing mechanism associated with each of the hinge structures **15**. Each mechanism further includes a tension rod **21** pivoted at its upper end, as shown at **22**, to the end of the arm **19** and having a flange **23** formed on its lower end for seating the free end of a helical compression spring **24** of conventional construction. The upper end of the spring **24** bears against the fixed casing structure **11** and is prevented from sliding laterally thereon by a finger **25** extending downwardly from the casing adjacent the periphery of an opening **26** formed therein (see FIG. 5). The opening **26** in the casing and a registering opening **27** in the fixed portion **16** of the hinge receive the rod **21** which extends downwardly within the casing **11**, as shown. For purposes to be described hereinafter, the intermediate portion of the rod **21** is bent as shown at **28** and one side of the rod **21** bears against a fixed bearing plate or fulcrum **29** preferably carried by the fixed portion **16** of the hinge. The bearing plate **29** and the hinge **15** may be secured to the casing by suitable fastening devices **30** (FIG. 5).

The hinge structure **15** may be at least partially enclosed by a cover **31** extending transversely across the rear margin of the casing **11**. Also, actuation of the lid between its horizontal closed position and its open positions may be effected by a handle **32** at the front margin of the lid. It will be understood that a suitable latching device (not shown) is employed for retaining the lid **10** closed in fluid-tight engagement with the gasket **13** and that this latching device is released by the handle **32** when the lid is raised. As handle-operated latches of this kind are well understood and form no part of this invention, per se, further description thereof is deemed unnecessary.

It is believed apparent that the moments of force of the lid **10** about the pivot **18** vary non-linearly as the lid **10** is moved between its horizontal closed position (FIG. 2) and its generally vertical, full open position of FIG. 4. As the lid **10** is moved in its opening direction, said moments of force would reduce in accordance with the cosine of the angle of the lid above the horizontal. This, of course, is non-linear; the moments reducing at a relatively slow rate during the early stages of the movement and, during a later stage beyond the half open or 45° position, of FIG. 3, the rate of reduction of the moment is relatively fast. In opposition to this moment, the conventional helical spring **24** acting through the lever arm **19** provides a counter or opening moment about the pin **18**. The bias or force of this spring varies linearly with movement of the spring.

During the early stage of movement of the lid from its closed to the approximate 45° position of FIG. 3, the reduction in spring force is very substantial and greater in proportion to the reduction of the moment due to the weight of the lid. During the later stage of movement of the lid from the position of FIG. 3 to the position of FIG. 4 assistance is given the expanded spring by varying the angular relation between the tension rod and the arm **19**. It will be noted that, during the movement of the lid **11** from the position of FIG. 2 to the position of FIG. 3, the spring remains bent or deflected substantially in an arc about its fixed end. The spring position is determined by the position of the fulcrum **29**, against which the rod **21** bears, relative the pivot **22** at the end of the rod. During this stage of

movement, it will be understood that the compressed spring has sufficient bias to substantially counterbalance the lid.

In the design illustrated, the aforementioned assistance that is given the spring during the later range of movement of the lid to the full open position (FIG. 4), is initiated when the curved portion **28** of the rod **21** passes over the fulcrum **29**. It will be noted that the bias provided by the lateral deflection of the spring tends to swing rod **21** to a vertical position about the fulcrum **29**. This biasing force does not become effective in assisting to overcome the closing moment of the lid **10** until the angle between the tension rod **21** and the arm **19** exceeds 90°. FIG. 3 illustrates the approximate position of the components of the counterbalancing mechanism as the lateral bias of the spring becomes effective. When the lid occupies positions between those illustrated in FIGS. 3 and 4 its closing moment is, as explained previously, of relatively low magnitude, so that it is readily counterbalanced by the remaining compression bias available from the spring **21** and the additional lateral bias from the spring.

It will be noted from FIG. 4 that when the lid **10** is fully open the spring **21** is nearly fully extended and substantially all of the lateral deflection has been removed from the spring, with the result that only a light counterbalancing force is applied to the lid. This reduction in counterbalancing force to more nearly match the closing moment of the lid as the lid approaches a fully open position is highly desirable in order to prevent the lid from banging to a stop, so to speak, as it is opened.

The fastening devices **30** preferably pass through enlarged openings **33** in the fulcrum plate **29** (see FIG. 5) to provied a means for adjusting the position of the fulcrum relative the other components of the counterbalancing mechanism. As can be readily appreciated, shifting the position of the fulcrum **29** changes the amount of lateral deflection imparted to the spring **24** and thereby adjusts the amount of assistance bias which the lateral deflection of the spring affords during the latter range of opening movement of the lid.

A counterbalancing mechanism, constructed substantially as shown, provides for retention of the lid in various angular positions to which it may be moved. This is advantageous during loading or for gaining access to the tub for any reason after a cycle is started. Dropping and slamming of the lid is prevented. The mechanism is simple in construction, utilizing an inexpensive coil spring and may be readily assembled and serviced.

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

What is claimed is:

1. In a counterbalancing mechanism, the combination with a member movable from a horizontal position to a substantially vertical position, a hinge having a movable portion fixed to the member and a fixed portion, a hinge pin pivotally connecting the fixed and movable portions of the hinge and pivotally supporting said member, an arm extending from said movable portion of the hinge, a helical compression spring having one end anchored adjacent the fixed portion of the hinge and its other end free, a tension rod pivoted to said arm and bearing against the free end of the spring for biasing the member toward its vertical position and a fulcrum engaging an intermediate portion of the rod during at least a portion of its travel for offsetting the free end of the spring and modifying the biasing effect of the spring upon said member.

2. In a counterbalancing mechanism for a cover movable from a horizontal closed position through a first range of movement to a partially open position and thence through a second range of movement to a generally vertical open position, a hinge pivotally supporting the cover, an arm movable with the cover, a tension rod pivoted to the arm and extending therefrom, a helical compression spring having one end thereof fixedly mounted and the other end free for movements axially of the spring and arcuately about the fixed end of the spring, said tension rod extending through the spring and supporting the free end thereof and a fulcrum engaging an intermediate portion of the rod and providing for angular movement of the rod relative the arm; the construction and arrangement being such that angular adjustment of the rod relative the arm in the second range of movement of the cover assists the spring in supporting the cover.

3. In a counterbalancing mechanism for a cover movable between a horizontal closed position and a generally vertical open position, a hinge including a pivot movably supporting the cover, an arm fixed to the cover and movable therewith, a tension bar pivoted to said arm, a helical compression spring for biasing the cover toward its open position and having its upper end fixedly positioned and its lower end free for movement axially of the spring and laterally with respect to the fixed upper end thereof, said tension bar extending through the spring and having its lower end bearing against the lower end of the spring, a camming surface formed on the bar intermediate its ends and a fulcrum engaging said camming surface, said camming surface and fulcrum effecting a change in the angle between the bar and said arm in the latter range of opening movement of the cover for assisting the spring in said range.

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