Feb. 11, 1936. R. L. BENSON 2,030,092

AUTOMATIC DISHWASHER

Filed Sept. 30, 1932 4 Sheets-Sheet 1

Fig. 1.

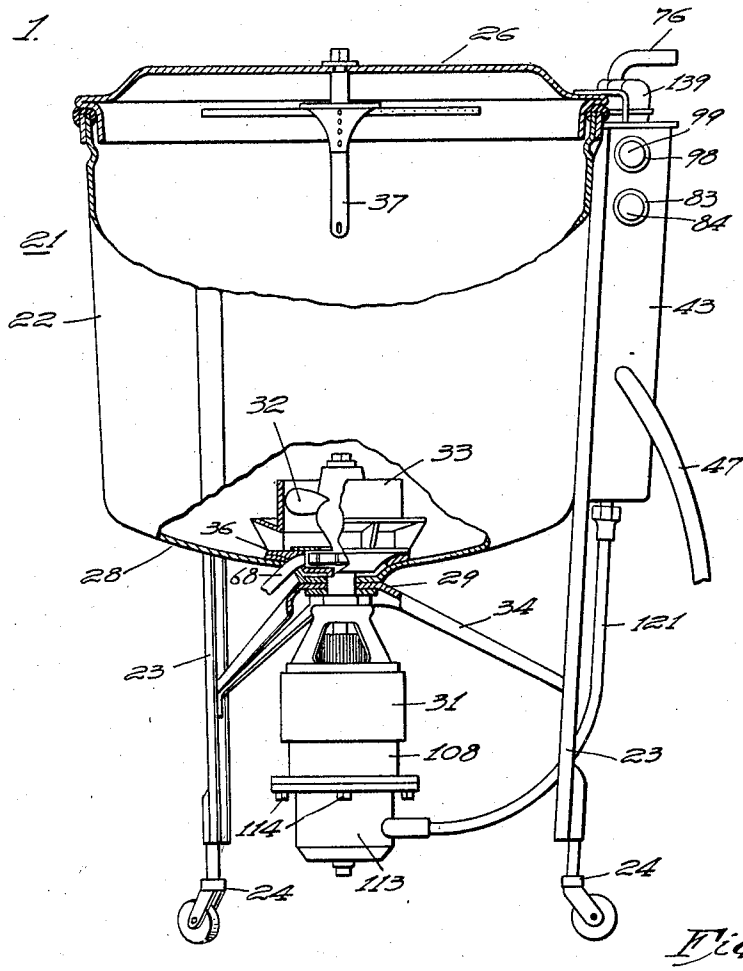


Fig. 3.

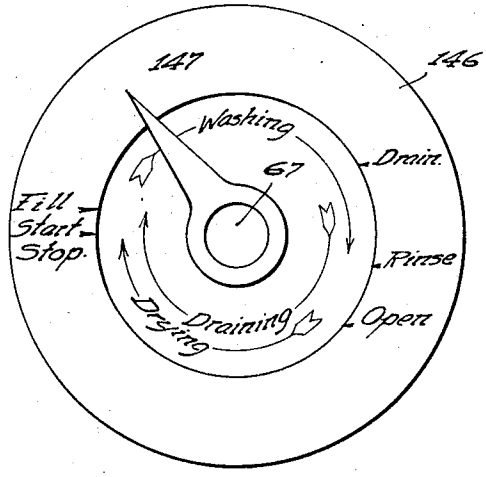
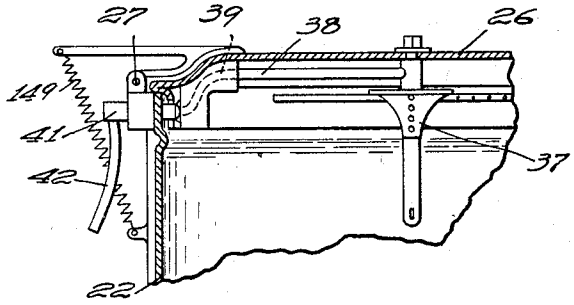


Fig. 2.



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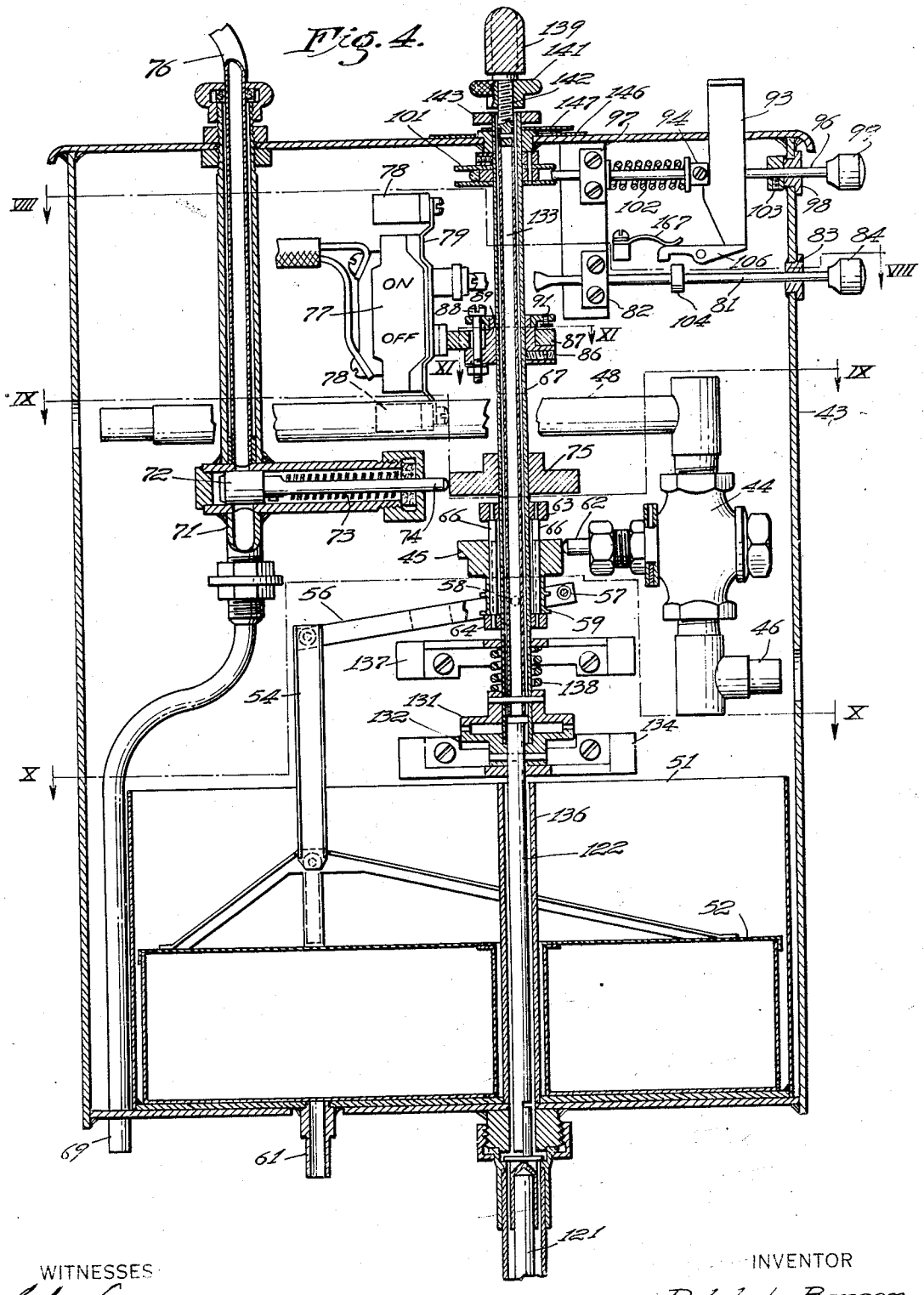
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Feb. 11, 1936. R. L. BENSON 2,030,092

AUTOMATIC DISHWASHER

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Fig. 4.



WITNESSES

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AUTOMATIC DISHWASHER

Filed Sept. 30, 1932 4 Sheets-Sheet 3

Fig. 5.

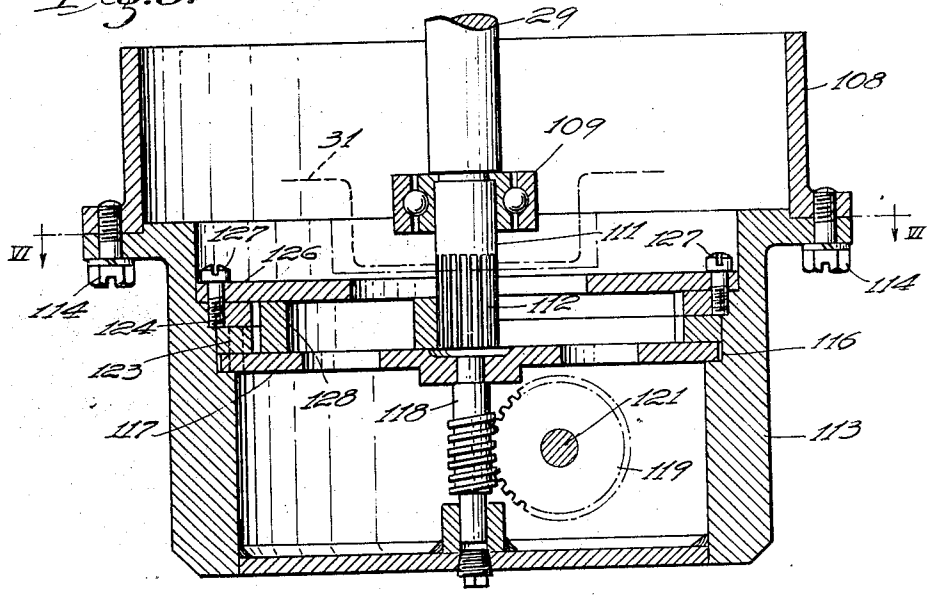
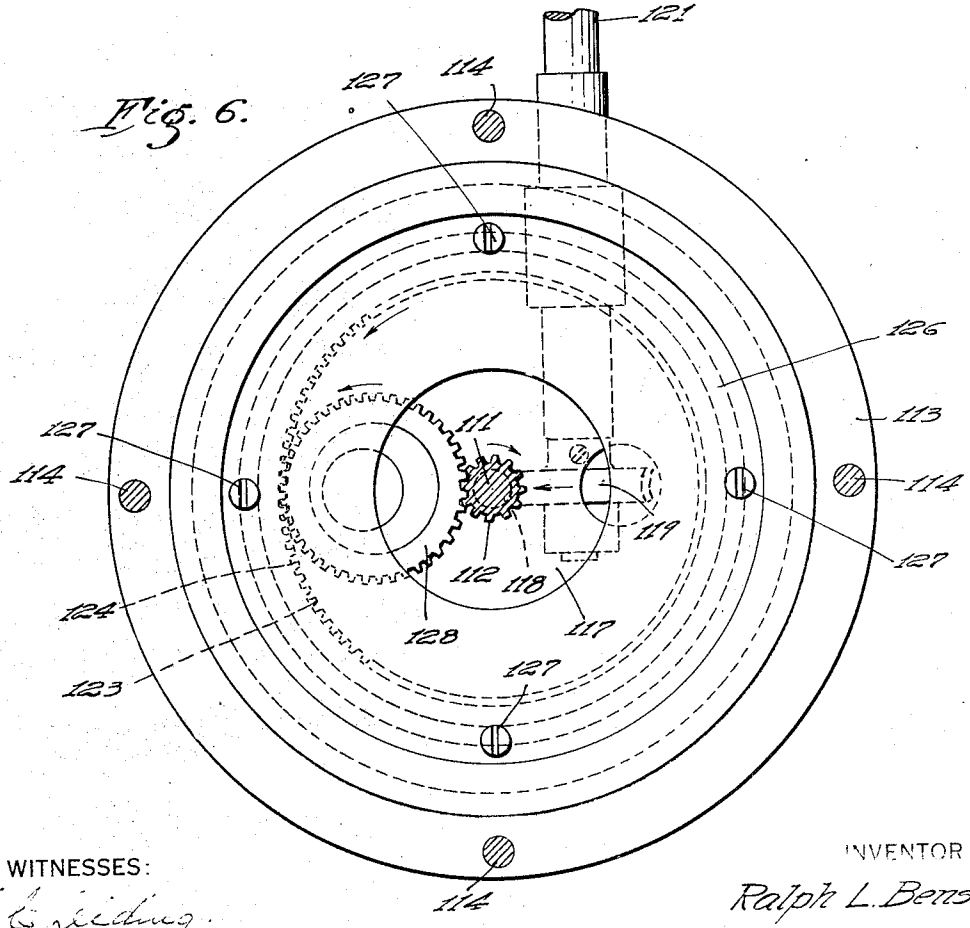


Fig. 6.



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AUTOMATIC DISHWASHER

Filed Sept. 30, 1932 4 Sheets-Sheet 4

Fig. 7.

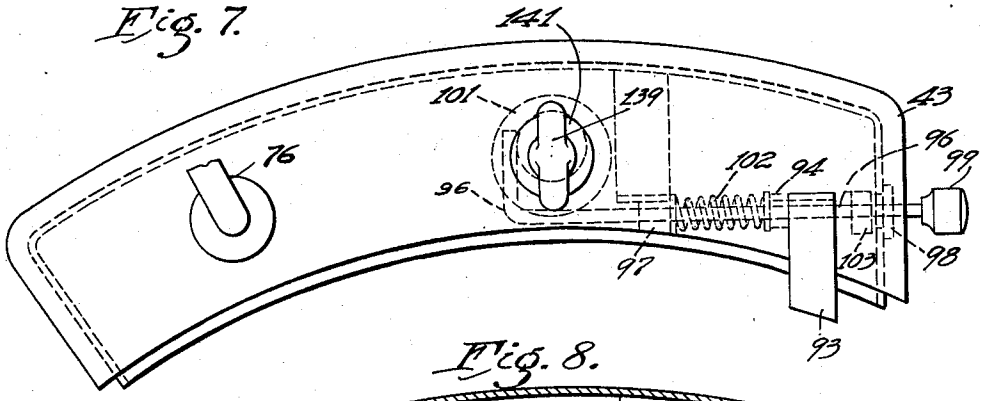


Fig. 8.

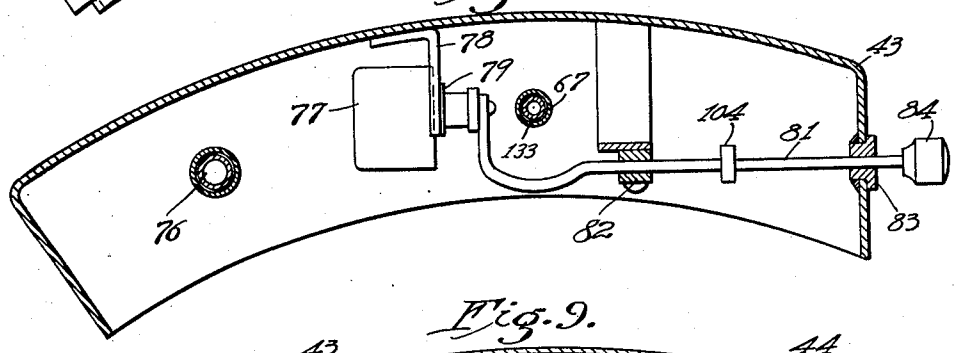


Fig. 9.

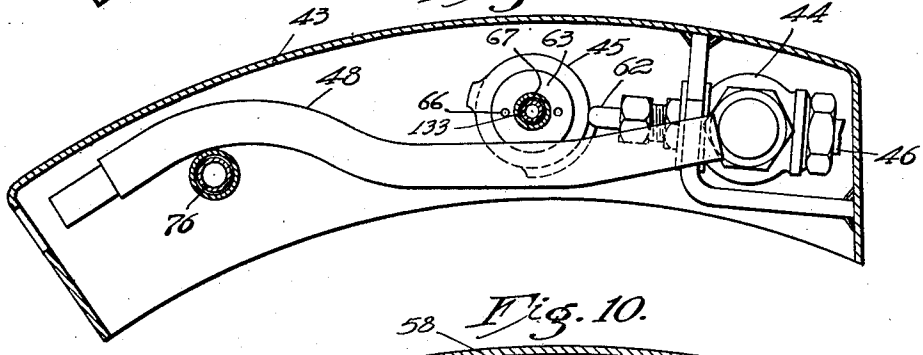
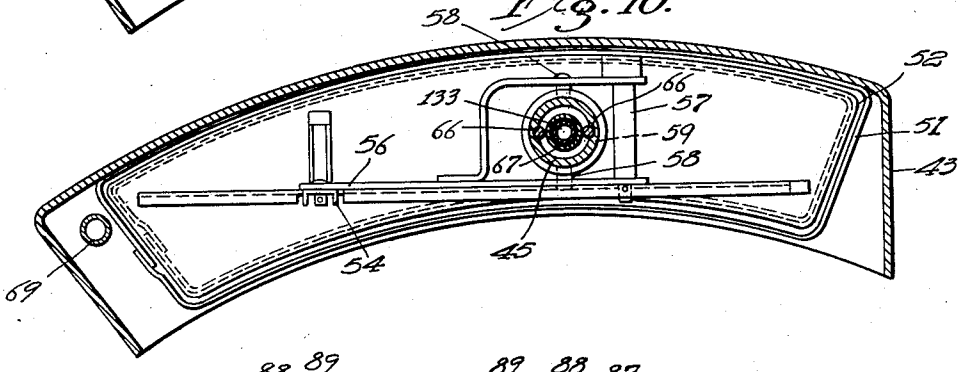


Fig. 10.



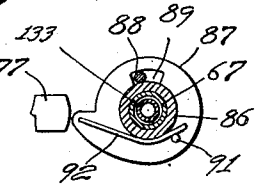


Fig. 11.

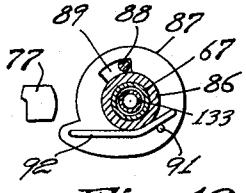


Fig. 12.

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Patented Feb. 11, 1936 2,030,092

UNITED STATES PATENT OFFICE

2,030,092

AUTOMATIC DISHWASHER

Ralph L. Benson, Toledo, Iowa, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 30, 1932, Serial No. 635,504

1 Claim. (Cl. 141—9)

My invention relates to dish washers and particularly to automatic control means therefor.

An object of my invention is to provide a relatively simple and compact mechanical control unit for a dish washer.

Another object of my invention is to provide a motor-driven mechanical control means for effecting a predetermined sequence of operations in a dish washer.

Another object of my invention is to provide means in a dish washer for preventing energization of the motor control switch when the cover of the tub is open.

Other objects of my invention will either be pointed out during the course of the description of the apparatus or will be apparent therefrom.

In practicing my invention, I provide, in combination with a dish washer, a casing which may be secured to the tub at some convenient point and in which is located a motor-driven shaft having a plurality of cams thereon which respectively open and close the water inlet control, the water outlet control, effect opening of the manually-closable motor control switch and control the latch for the cover. This cam shaft is driven by a flexible shaft from the motor, a speed reduction gear mechanism being provided, which mechanism is directly supported by the motor itself.

In the drawings,

Figure 1 is a view mainly in side elevation but with portions of the dish washer broken away and embodying a device embodying my invention,

Fig. 2 is a fragmentary vertical sectional view showing the water inlet of a dish washer,

Fig. 3 is a top plan view of an indicating mechanism,

Fig. 4 is a view, in vertical section, of a control unit embodying my invention,

Fig. 5 is a view in vertical section, through a speed reducing mechanism,

Fig. 6 is a view, in horizontal section therethrough, taken on the line VI—VI of Fig. 5,

Fig. 7 is a top plan view of a control unit,

Fig. 8 is a view, in horizontal section, through the control unit, taken on the line VIII—VIII of Fig. 4,

Fig. 9 is a view, in horizontal section, through the control unit, taken on the line IX—IX of Fig. 4,

Fig. 10 is a view, in horizontal section, through the control unit, taken on the line X—X of Fig. 4,

Fig. 11 is a view, in horizontal section, showing the motor switch actuating cam assembly and taken on the line XI—XI of Fig. 4, and

Fig. 12 is a view taken on the line XI—XI but with the cam in another position relatively to the shaft.

Referring initially to Fig. 1 of the drawings, I have there illustrated a dish washer 21 as being of the portable type and including a casing or tub 22 mounted on a plurality of supporting legs 23 which are each provided with casters 24 in the usual manner. The tub 22 is provided with a cover 26 which is hinged to the top of the tub 22 as shown at 27.

The bottom portion 28 of the tub is provided with an opening therein through which there extends the driving shaft 29 of a motor 31, which motor is located below the tub. The shaft 29 has an impeller 32 mounted thereon surrounded by a shroud 33 in order that the proper movement of the water by the impeller may be effected. These parts are shown generally only as they constitute no part of my immediate invention. Braces 34 are provided to properly brace the supports 23 from the tub and relatively to each other and the usual means are provided in cooperation with the shaft 29, the shroud 33 and the upper portion of the motor frame assembly in order to make a water-tight joint, such as is necessary in a construction of this kind.

As the dish washer illustrated in Fig. 1 of the drawings is of the portable type, it is necessary to provide means for removing the water from the tub 22 and for this purpose I have provided a pump 36 of any suitable or desired kind, which pump is also mounted on the motor shaft hereinbefore mentioned.

Hot water enters the tub through a spraying device 37, which as shown in Figs. 1 and 2 of the drawings is rotatably mounted in the cover 26 and which includes a supply conduit 38 extending from a member 39 having a tortuous opening therethrough, the conduit 38 fitting into one end of the member 39, while the other end of the member 39, fits more or less resiliently against a conduit 41 to which is attached a flexible hose 42.

Referring now to Fig. 4 of the drawings, I have there illustrated the assembled control unit as mounted in an auxiliary casing 43, which casing may be mounted against the outside of the tub 22, as is shown more particularly in Fig. 1 of the drawings. This control assembly is entirely mechanical and is so arranged as to permit of partially filling the tub with hot water, after which the in-flow of water is terminated and the impeller, driven by the motor, is allowed to spray the

water against such dishes as may have been placed in the tub, after which the water is pumped out of the tub, another supply of hot rinsing water is caused to enter the tub, which water is, however, immediately and continuously drained therefrom, after which the impeller is operated for a certain length of time to dry the dishes. All of these operations are effected by cams on a continuous turning movement of a shaft, which makes one complete turn or rotation for each cycle of operation.

A water inlet valve 44, of the self-closing variety, is initially controlled by a cam 45 and the inlet 46 of valve 44 is connected as by a hose 47 to a suitable supply of hot water. A conduit 48 connected to the upper part of valve 44 extends laterally across the auxiliary casing 43 and may have the hose 42 connected thereto, through which the water may enter the tub 22 through the spraying device 37.

The cam 45 is provided with two projections, one of which is of greater circumferential extent than is the other (see Fig. 9). The wider peripheral projection is operative to cause opening of the valve 44 to permit a relatively large quantity of hot water to enter the tub and to be used to wash the dishes. The narrower peripheral projection of the cam is operative to open the valve 44 to permit a smaller quantity of rinse water to enter the tub to rinse the dishes. Each of these projections effects an opening of valve 44 by depressing the actuating stem 62 thereof. This stem is normally biased outwardly by a suitable spring (not shown) inside the valve which returns the gate member to the closed position as soon as the cam projections release the stem.

Means for shutting off the valve 44 after a predetermined amount of wash water has entered the tub, includes a float chamber 51 which is located in the bottom part of casing 43 and has a float 52 therein, the upper end of which has connected thereto a link 54, the upper end of which link is pivotally connected to one end of a lever arm 56, the other end of which is pivotally mounted on a pivot pin 57 (see Fig. 10).

The lever arm 56 is provided with a forked end, as shown in Fig. 10 of the drawings, each of the two portions thereof being provided with a pin 58 which fits into a peripheral recess in cam 45 and indicated at 59 in Fig. 4 of the drawings. It is thus evident that if the float chamber 51 is connected by a conduit 61 with the tub 22 the water level in the float chamber 51 will be the same as that in the tub 22 and cause the float 52 to move upwardly whereby to move the cam 45 upwardly. When this upward movement of the cam occurs the actuating stem of the valve 44, indicated by 62, will move in such direction as to cause the valve 43 to close. This, therefore, results in permitting a predetermined amount of wash water to enter the tub and to be sprayed or splashed or otherwise moved by the impeller to strike the dishes to wash them.

In order to permit of the axial movement of cam 45, I provide an upper annular member 63 and a lower annular member 64 spaced apart a sufficient distance and having two axially extending pins 66 therebetween. The two annular members 63 and 64 are suitably secured against the tubular main shaft 67 as by machine screws (not shown). The inner or central portion of cam 45 is so shaped as to receive the two pins 66 in such manner that the cam 45 may move axially of shaft 67 but must turn therewith.

As has already been stated, the device illustrated in the drawings is a movable one and it is, therefore, necessary that means be provided for controlling the out-flow of used water as the same is forced outwardly by pump 36. For this purpose, the pump 36 forces water into a conduit 68 suitably connected with the pump housing, which conduit is connected to a relatively fixed pipe 69 shown in the lower left-hand corner of Fig. 4 of the drawings. The upper end of pipe 69 is connected to the lower end of an outlet valve assembly 71, the flow of water therethrough being controlled by a piston 72 which is biased to its open position by a spring 73. In the drawings, the piston 72 is shown in its closed position and the construction of the control means therefor is such that the spring 73 tends to pull the piston 72 to the right and into its open position, but is normally prevented from doing this by reason of the fact that a stem 74 constituting a part of piston 72 is engaged by a cam 75. The cam 75 is provided with a peripheral portion which is so shaped as to cause opening and closing of the valve 71 at the proper and desired times. The upper end of valve 71 may have connected therewith a flexible conduit 76, such as a hose, the other end of which may be located in a sink or in some other suitable water outlet.

A motor control switch 77 which is of the double push button type is suitably located in the casing 43 and may be supported by brackets 78 which are shown more particularly in Fig. 8 of the drawings. The switch 77 is supported as by a cross piece 79 extending between the two brackets 78, as may be seen in Fig. 4 of the drawings. The switch 77 is manually operable by a rod 81 which extends through a suitable bearing 82 and through a bushing 83 located in the side wall of casing 43, the rod 81 having a knob 84 at its outer end to be grasped by the operator.

Means for moving the switch 77 to its off position includes a cam assembly shown more particularly in plan view in Figs. 11 and 12 and including one portion 86 suitably fixedly mounted on shaft 67 and having yieldingly associated therewith a cam member 87 which is shown in Figs. 11 and 12 of the drawings. As noted above, the cam 87 is loosely connected to member 86 and has a predetermined limited peripheral movement relatively to member 86 which movement is limited by a machine bolt 88. The machine bolt 88 fits into a recess 89 in the inner surface of cam 87. A pin 91 is provided in the upper portion of the fixed member 86 and is engaged by a spring 92 which may be of rod shape and which has one end thereof fitting into an opening in the upper surface of cam 87. The use of this resiliently mounted and movable cam 87 will be set forth hereinafter.

The cover of the tub is provided with a latch member 93 which extends beyond the cover, as may be seen by reference to Figs. 1, 4 and 7 of the drawings and which is adapted to be engaged by a lug 94 which is mounted on a rod 96 of L-shape, which rod may move in a bearing 97 and a bushing 98 and be provided with an actuating knob 99. A cam 101 is fixedly mounted on the rotatable tubular shaft 67 and the surface of this cam member is eccentric to the axis of shaft 67. The rod 96 is yieldingly pressed toward the right by a compression spring 102 and a stop collar 103 may be located on the rod 96 and engage the bushing 98 to limit the movement of rod 96 in a right-hand direction. The position of cam 101 is such that when the motor

is deenergized and all of the control parts are in the position shown in Fig. 4 of the drawings, the rod 96 is moved toward the left to thereby release latch member 93 and permit the cover to open.

An interlock is provided between the manually operable rod 81 and latch 93, which interlock is shown in Fig. 4 of the drawings as including a collar or lug 104 on rod 81 and a pivotally mounted latching arm 106 which is normally spring pressed into engagement with collar 104 by a spring 107 in order to prevent inward movement of rod 81 as long as the latch 93 is not in operative engagement with one end of member 106. There is thus provided an interlock which ensures that the cover must be closed before it is possible to manually close the motor control switch.

Referring now to Figs. 5 and 6 of the drawings, I have there illustrated one form of speed reducing mechanism directly actuated by motor shaft 29. The motor housing is indicated by numeral 108 in Figs. 1 and 5 of the drawings and is so arranged as to support a thrust ball bearing 109, the shaft 29 having an extension thereon indicated by numeral 111, the lower end of this extension being provided with a plurality of teeth 112 to constitute a pinion. A housing 113 has a flange portion by means of which it may be bolted against the bottom of housing 108 as by a plurality of short bolts 114. The housing 113 has a shouldered portion therein adjacent to the upper end and indicated by 116 on which is supported a rotatable circular plate 117 from which there depends a short worm shaft 118 which meshes with a worm gear 119. A flexible shaft 121 is suitably connected to worm gear 119 and extends between it and the lower end of a shaft 122 shown more particularly in Fig. 4 of the drawings and which will hereinafter be described in detail.

The circular plate 117 has secured against its upper surface a ring gear 123 having a plurality of inner teeth. A second ring gear 124 is located immediately above the lower ring gear 123 but contrary to ring gear 123, gear 124 is fixedly held in its position and prevented from rotating by an upper annular plate 126 which is securely bolted against part of casing 113 by a plurality of short machine screws 127. Ring gear 123 has one tooth more or less than ring gear 124. The teeth 112 on the end of shaft 111 mesh with a planetary ring gear 128, the operation of this assembly being substantially as follows:

The shaft 111 rotates, of course, at the same speed as the motor shaft, that is, if a four pole induction motor is used, it will operate at about 1720 R. P. M. The teeth of the planetary gear 128 mesh with both of the internal teeth ring gears and as ring gear 124 is fixed, ring gear 123, having one tooth more or less than its companion gear, will move peripherally through one tooth for each revolution of gear 128 around shaft 111. It is to be noted further that member 117 to which worm shaft 118 is secured, will be operated at a greatly reduced speed and that worm gear 119 will be operated at a very much more reduced speed. I am thus able to obtain a speed reduction of about 17,000 to 1, so that shafts 122 and 67 will move or turn through one complete revolution in about 10 minutes.

Thus, if it be assumed that an operator has placed dishes or other ware in the tub to be cleansed and has then manually moved rod 81 inwardly to energize the motor, after the cover has been closed and latched in place, the motor will start and it is necessary to permit it to continue to operate through one complete cycle before it can be otherwise controlled. This has the result that an operator cannot normally interfere with the lengths of time of any particular part of the entire cycle. This means also that it is necessary to determine the optimum cycle of operation and particularly for each of the different portions thereof and then to fix the same by the means already described so that the same results will be obtained each time that the device is operated. It may be necessary or desirable to operate under emergency conditions with a manual control, which is effected substantially as follows:

A manually actuable clutch coupling includes two crown gears 131 and 132, the former being slidably but non-rotatably mounted on tubular shaft 67 and attached to an inner shaft 133 as shown in Fig. 4 of the drawings. The latter crown gear is mounted fixedly on the upper end of shaft 122 to turn therewith and a suitable bearing bracket 134 is provided for the upper end of shaft 122. A tubular member 136 extends through float chamber 51 so that shaft 122 may move freely therein. An upper bearing bracket 137 is provided for the lower end of the tubular main shaft 67 and a compression spring 138 extends between gear 131 and bracket 137 to yieldingly maintain the two crown gears in operative engagement. An actuating knob 139 is provided at the upper end of shaft 133 and a knurled nut 141 has screw threaded engagement on an extension 142 fixedly mounted at the upper end of rod or shaft 133. A flange member 143 is fixedly mounted on the upper end of tubular shaft 67 and may be engaged by the lower surface of member 141 so that, by turning member 141 in the proper direction, shaft 133 may be forced upwardly to disengage the two crown gears 131 and 132. When this occurs, it is, of course, obvious that the motor will no longer drive shaft 67 with all of the cams thereon and it is, therefore, possible to manually move shaft 67 to any desired position or to leave it in any desired position. It is further obvious that such manual operation is more or less an emergency operation as it is not my intention to operate the control system manually except in occasional emergency conditions.

Referring to Fig. 3 of the drawings, I have there shown a dial 146 having a number of insignia thereon as well as arrows to indicate the momentary position of the device as to its cycle of operation, a pointer 147 being provided on tubular shaft 67 to cooperate with the data on the dial.

Let it be assumed that an operator has placed a number of dishes in the tub 22 and also some soap powder and that the proper hose connection has been made with a suitable supply of hot water, and also that the hose for the water outlet has been connected with a suitable waste pipe. In that case, pointer 147 of Fig. 3 would be in the position to the left, and immediately over the word "start". After the operator has closed the cover, he is able to push on knob 84 to close the motor starting switch 77 to thereby energize the motor. The pointer 147 will begin to turn in a clockwise direction and at the point marked "fill" the cam 45 will cause opening of valve 44 to permit a predetermined quantity of water to flow into the tub, float 52 moving upwardly gradually as the water level in the tub rises, until it has moved upwardly far enough

to move cam 45 upwardly enough to bring another part of its surface of smaller radius in engagement with rod 62 whereby the valve 44 will be caused to close. At this time, and for a certain length of time thereafter the full amount of water in the tub 22 is agitated by the impeller 32 whereby the dishes are washed in a proper manner.

As the motor continues to operate, pointer 147 moves over the point indicated by "drain" in Fig. 3 of the drawings at which time cam 75 has been so turned that it permits piston 72 to move to its open position and pump 36 will force substantially all of the water in the tub outwardly through hose 76. A short time thereafter, cam 45 which has been moved downwardly by the action of float 52 settling as the water level in the tub was lowered, will again cause opening of valve 44 to permit rinse water to enter the tub, this being indicated by the word "rinse" on the dial. It is to be noted, however, that the rinse water is pumped outwardly as fast as it enters the tub, because the shape of cam 75 is such as to hold piston 72 in its open position to permit the rinse water to be immediately drained.

At the point marked "open", the catch member 94 for latch 93 is moved toward the left and the cover 26 is opened as by a spring 149. The impeller 32 continuing to rotate will circulate heated air around the dishes so that they are dried and this part of the operation is indicated by the relatively long arrow marked 'drying" in Fig. 3 of the drawings.

While I have illustrated a control mechanism casing as applied to a movable tub, I do not desire to be limited thereto, as I may locate all of the hereinbefore described control mechanism at some suitable part of a sink-type dish washer, that is, one which is not movable and in which case, I may locate the mechanical control mechanism anywhere on the sink structure just so long as it performs substantially the same functions as have already been described.

Reference is again made to the control switch shut-off cam 87 with particular reference to the necessity for having it yieldingly mounted, as has already been described. It is obvious that the motor 31 will be stopped quickly as soon as its energizing circuit is interrupted and it might happen that the projecting portion of cam 87 would freeze, so to speak, against the actuating knob of switch 77 in which case, it might happen that the switch could not be reclosed. As soon as the projecting knob of cam 87 is practically clear of the switch actuating knob, it is quickly moved from the position shown in Fig. 11 to that shown in Fig. 12, whereby it is possible for an operator to immediately manually reclose switch 77 and go through another cycle of operation.

The device embodying my invention thus provides a relatively simple mechanical control means for ensuring that the operating parts of a dish washer shall go through a predetermined cycle of operation which can normally not be interfered with, although means are provided for permitting of such interference in case of absolute necessity. Once an operator has closed the cover, he is able to manually energize the switch for the motor control circuit, after which all of the other operations will occur in proper timed sequence.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claim.

I claim as my invention:

In a dishwasher comprising a container, and a self-closing water-inlet valve therefor, the combination of control means for said valve comprising a shaft adapted to be slowly rotated, a cam mounted on said shaft to rotate therewith but to be free to axially slide thereon, said cam being so shaped as to open said valve during a portion of the shaft rotation when in one axial position on the shaft and to completely release the valve when in a second position on the shaft, and a float responsive to the level of the water in the container for shifting the said cam from the first-named axial position on the shaft to the second-named position when the water level rises to a given height in the container.

RALPH L. BENSON.