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CENTRIFUGALLY OPERATED VALVE FOR ROTATABLE RECEPTACLES

Filed Aug. 6, 1949

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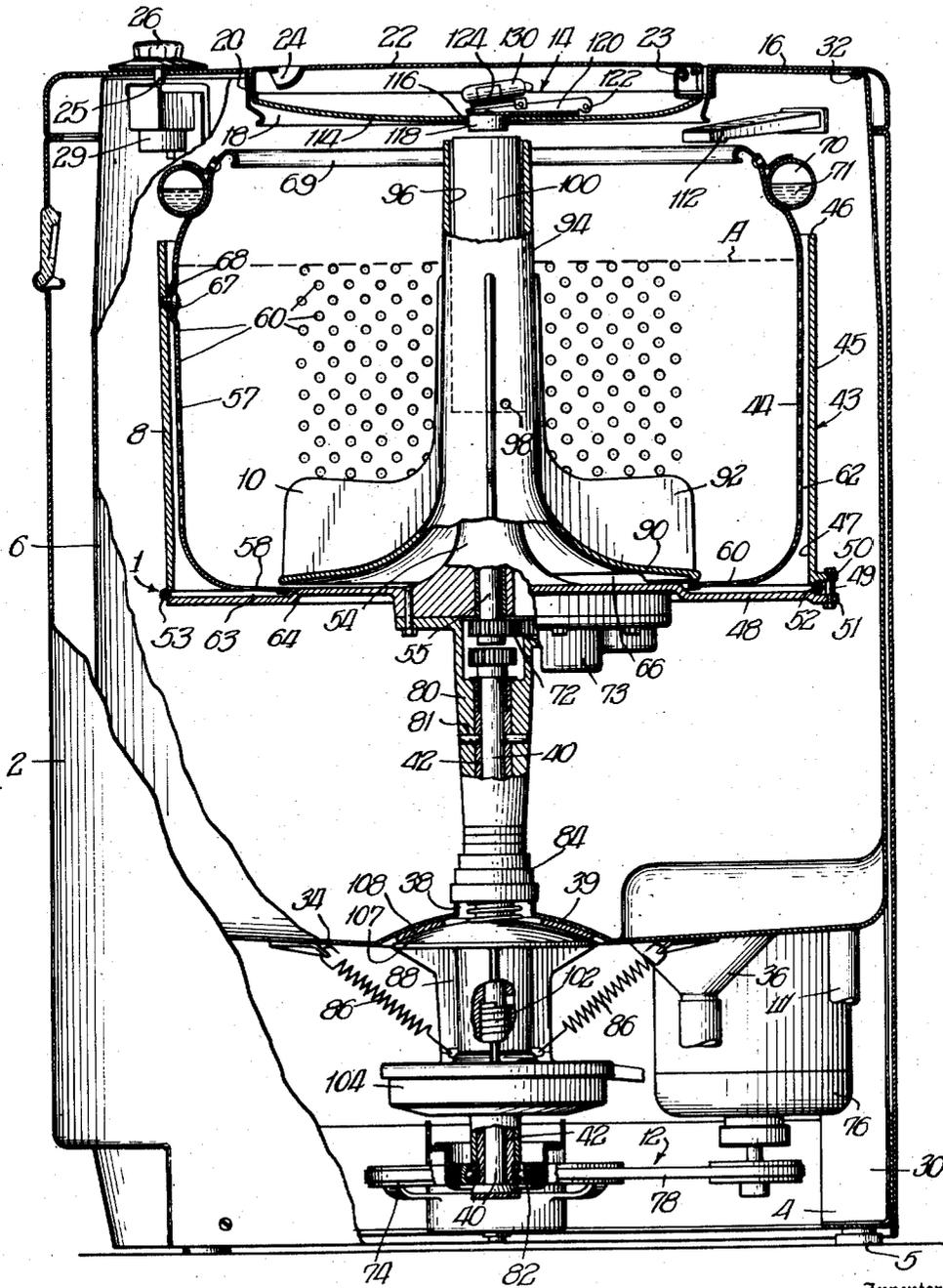


FIG. 1

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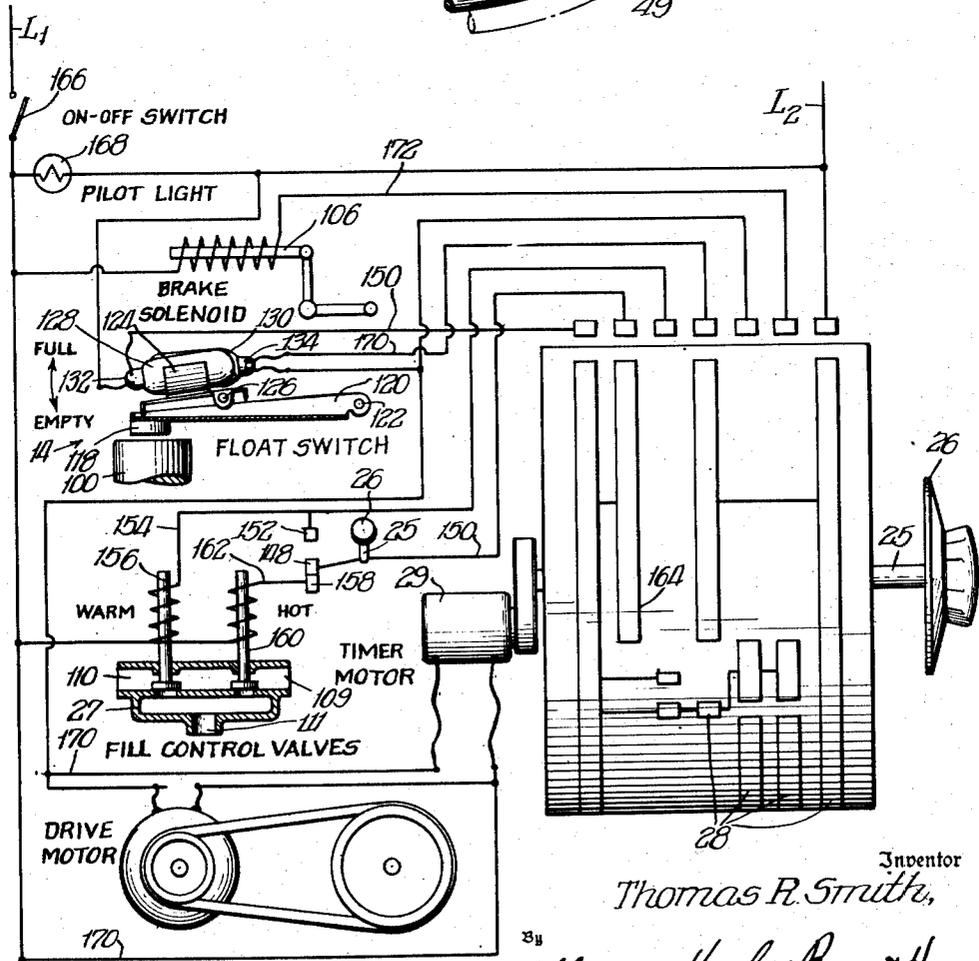
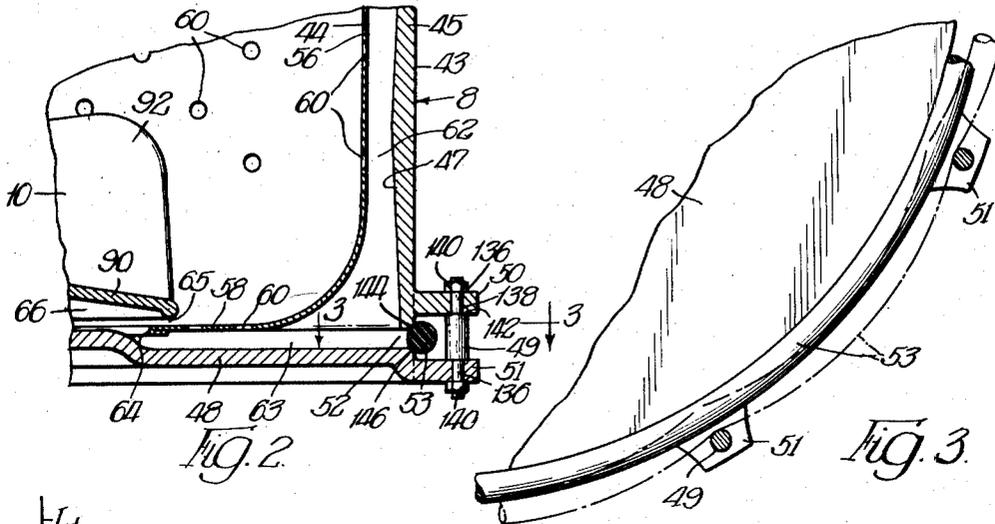


FIG. 4

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UNITED STATES PATENT OFFICE

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CENTRIFUGALLY OPERATED VALVE FOR ROTATABLE RECEPTACLES

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Application August 6, 1949, Serial No. 108,991

11 Claims. (Cl. 68—23)

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This invention relates to washing machines, and more particularly to washing machines having rotatable tubs provided with improved centrifugally operated valve means.

Among the objects of the invention is to provide a washing machine with an improved rotatable tub construction which when rotated at a relatively high speed provides a means for removing heavy particles of dirt and foreign matter therefrom.

In washing machines having rotatable tubs wherein a washing operation and a centrifugally drying operation takes place there are times, when washing some fabrics, that heavy particles of dirt, sand, etc. will settle out of the fabrics being washed. These particles tend to collect in the bottom of the tub during the washing operation and when the tub is rotated to extract the liquid a portion of the heavy dirt or foreign matter may be forced back into some of the fabrics which, of course, causes the same to be spotted or soiled. Even in installations wherein a space or sediment trap is provided for heavy dirt to settle out of contact of the fabrics being washed, the dirt is not always removed therefrom when the tub is rotated and it may accumulate therein until it eventually clogs the sediment trap. This is especially so in installations where the settling space is not readily accessible for manual cleaning.

Accordingly it is an object of the invention to provide a washing machine having a rotatable tub which is provided with a settling space at the lower portion thereof for heavy particles of dirt and to remove the same from the space centrifugally through a passage at the lower portion of the tub when the tub is rotated.

It is another object of the invention to provide a washing machine having a rotatable tub which is provided with a space at the lower portion thereof for the accumulation of heavy particles of dirt during the washing operation and centrifugally operated resilient valve means disposed about a circumferential passage in the periphery of the tub capable of preventing leakage when the tub is stationary and which is opened by centrifugal force when the tub is rotated at relatively high speed to permit a direct flushing action of water through the space to remove the particles of dirt therefrom.

It is yet another object of the invention to provide a sediment trap in a rotatable tub for a washing machine which is self-cleaning.

Other objects, features, capabilities and advantages are comprehended by the invention as

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will later appear and as are inherently possessed thereby.

The present application discloses subject-matter relating to applicant's co-pending applications, Serial No. 97,012, filed June 3, 1949, now Patent No. 2,641,918, issued June 16, 1953, and Serial No. 121,974, filed October 18, 1949.

Referring to the drawings:

Figure 1 is a partial vertical sectional view showing a washing machine with a rotatable tub for extracting liquid from the materials being washed and having an improved annular centrifugally operated valve means applied thereto;

Figure 2 is a partial enlarged view showing more in detail the construction of the lower portion of the rotatable tube and the centrifugally operated valve means;

Figure 3 is a partial horizontal cross-sectional view of the rotatable tub taken in the plane represented by the line 3—3 of Figure 2 showing the passage in the lower portion of the tub and the annular centrifugally operated valve means; and,

Figure 4 is a diagrammatic wiring diagram of a control for a washing cycle for an automatic washing machine to which a device of this type would be applicable.

Referring now more in detail to the drawings for one form of a combined washing and drying machine, embodying a centrifugally operated valve mechanism 1 made in accordance with the present invention, there is shown an outer cabinet 2, secured to a base structure 4 having adjustable leg portions 5 for completely enclosing the operating parts of the machine. The base 4 provides a support for an outer stationary tub 6, a support for an inner rotatable tub 8, mounted for rotation about a vertical axis, having an agitator or washing device 10 disposed therein, as well as a support for mechanism, generally referred to as 12, for operating the agitator 10 and for rotating the tub 8 in a washing cycle, as will be hereinafter more fully disclosed. The washing machine further includes a control mechanism generally referred to as 14 for automatically controlling certain operations in the washing cycle.

The cabinet 2 has its main body portion formed with side, front and back panels with a top or cover panel 16 secured thereto to provide a substantially rectangular unitary structure. The top panel 16 is preferably formed with an opening 18 defined by a downwardly and inwardly extending flange 20 to permit access to the inner rotatable tub 8 and is normally closed by a sec-

tional lid 22, preferably formed hollow to enclose the control mechanism 14, and hinged at 23 to the top panel 16 to pivot about a horizontal axis. In addition, the lid is recessed remote from the hinge 23 to provide a handle or grip 24 which can be readily grasped by the operator to swing the same into and out of its closed position. In this instance, the top panel is further formed with two openings adjacent the front corners thereof, each of which has a control shaft 25 extending upwardly therethrough with a control knob 26 mounted thereon adapted to be grasped by the operator for manipulation. One of the control shafts is adapted to be adjusted for controlling a thermostatically operated mixing valve 27, and the other is adapted to be manipulated by the operator for manually positioning a plurality of cams 28 normally driven by a timer motor 29 through any suitable speed reduction mechanism for automatically controlling the washing cycle, as diagrammatically shown in Figure 4 of the drawings.

The outer stationary tube 6 may be supported, in any suitable manner, by a plurality of corner posts 30 and is preferably formed circular in horizontal cross-section, with an upper open end 32 disposed adjacent the lower portion of the top panel 16 and a lower bottom portion 34 having a drain opening 36 and an enlarged opening 38 in a centrally located crowned portion 39 through which vertical co-axial shaft means extend. The shaft means is in the form of an inner rotatable shaft 40 and an outer rotatable tubular shaft 42, for supporting and rotating the inner tub 8 and for actuating the agitator 10.

Disposed within and at the upper portion of the outer stationary tub 6 and secured to the upper end of the outer tubular shaft 42 is the inner rotatable tub 8, also preferably circular in horizontal cross section and it is formed in two sections to provide an outer tub or receptacle 43 and an inner tub or container 44. The outer tub or receptacle 43 is substantially cup-shaped in vertical cross-section with its open end facing in the direction of the cover and has an imperforate cylindrical side wall 45 with a major portion thereof tapering upwardly and outwardly toward the open end which terminates to define a top edge 46 adapted to extend above the normal liquid level A desired for washing. The lower portion of the side wall 45 is tapered slightly at 47 toward a generally horizontal bottom wall 48 and is spaced therefrom by means of a plurality of spacing elements 49 disposed between, integral and outwardly extending flange portions 50 and 51 on the lower portion of the side wall and the outer periphery of the base 48, respectively, to define an annular circumferential discharge passage 52 therebetween. This passage is sealed against liquid flow when the tub 8 is stationary by means of an annular resilient centrifugally operated toroidal valve or O ring member 53 disposed about the outer periphery of the base and side wall in a manner to be hereinafter described.

Below the agitator 10 the base 48 is crowned to provide a hub 54 through which a vertically disposed oscillatable shaft 55 extends and it is splined or connected in any suitable manner to the agitator 10 for actuating or oscillating the same about a vertical axis to agitate the water and fabrics to be washed therein. Any suitable sealing means may be utilized between the hub and the shaft 55 to provide a fluid-tight joint.

The inner tub 44 is in the form of an open-ended cylindrical basket or container having the

lower portion of its side wall 57 and the bottom 58 perforated at 60 and disposed in substantially parallel spaced relation with the side wall 45 and bottom 48 of the imperforate receptacle 43 to provide a relatively narrow space 62 therebetween for the circulation of washing liquid during the washing operation and to permit free flow of the washing liquid out of the receptacle and over the top edge 46 when it is rotated. In addition the openings 60 in the bottom 58 of the basket permit heavy particles of dirt and foreign matter to flow therethrough and settle in the lower portion of the space 62 during the washing operation. Therefore, the lower portion of the space 62 between the bottom wall 48 of the receptacle and the bottom 58 of the basket is utilized as a sediment zone or space 63 since it tends to restrict the recirculation of heavy dirt and foreign particles back into the materials being washed. Also, the inner end 64 of the bottom 58 of the basket terminates under the lower portion of the agitator and is spaced therefrom to define a passage 65 to permit liquid and heavy dirt to flow therebetween around the end of the basket into the sediment zone 63. This particular construction also places the space 66 under the agitator in direct communication with the sediment zone 63.

The basket may be secured in spaced relation to the receptacle 43 to form a unitary structure in any suitable manner, such as, for example, by screws 67 disposed in recesses 68 provided therefor adjacent the upper portion of the receptacle. The upper portion of the basket is preferably imperforate and extends upwardly and inwardly above the normal liquid level and terminates to define an opening 69 disposed in alignment with the opening 18 in the cover 16, whereby the operator may have access to the interior of the basket when the lid 22 is opened.

Although forming no part of the present invention, it is to be noted that the upper portion of the basket 44 has mounted thereon a hollow toroidal balancing member or ring 70 preferably containing a mobile material 71, of any suitable type, having a relatively high specific gravity, which serves as a balancing means for tending to maintain the rotatable tub 8 in its vertical position when it is rotated at relatively high speed, above its critical speed, under unbalanced conditions.

Means for oscillating the agitator 10 are provided by suitable oscillating mechanism generally indicated at 72 which, in this construction, is carried in a gear housing 73 disposed at the bottom of and bolted to the rotatable tub 8 to increase the mass thereof. This oscillating mechanism is preferably directly operated by the inner vertical rotatable shaft 40 which has a drive pulley 74 secured thereto at its lower end, the same being continuously rotated in one direction by a motor 76 when energized, by means of a belt 78. The gear housing 73 is further provided with a downwardly projecting hub portion 80 concentric with the shaft means and rigidly secured to the upper end of the tubular shaft 42 by means of pins 81, while the lower end of the shafts 40 and 42 are mounted in a combination radial and thrust bearing 82 adjacent the lowermost portion of the base 4. Leakage between the outer tubular shaft 42 and the stationary tub 6 is prevented, where the shaft means traverses the tub at the crowned opening 38, by means of a resilient spring biased seal or boot 84 having upper and lower sealing surfaces adapted to en-

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gage the lower portion of the hub 80 and an upstanding portion on the stationary tub about the opening 38, respectively.

The combined radial and thrust bearing 82 provides the sole support for the rotatable tub 8 which is free to tilt thereabout at which time the upper portion of the tub will move laterally with respect to the opening 18 in the top panel 16. Accordingly means are provided to maintain the tub in a substantially vertical position during the washing operation and, although it is not absolutely necessary, it is desirable to have the means act to aid in centering the same when the tub is rotated. In this instance, a plurality of oppositely disposed, preferably four, centering springs 86 disposed at an angle to produce a component of force axially of the shaft means, in addition to the centering action, are connected at one of their ends to the bottom 34 of the stationary tub and the opposite ends are connected to a damper housing 88 disposed adjacent to and beneath the bottom 34 of the stationary tub 6. This damper housing is also disposed eccentric with and journaled on the outer shaft 42 and moves laterally therewith.

The agitator 10, disposed within the rotatable tub 8, is formed with a flaring base or body portion 90 extending downwardly and outwardly about the hub 49 to underlie the clothes and to overlap the inner edge 64 on the basket 50, and has one or more blades 92 extending radially upwardly and outwardly from the upper portion of the base 90 adapted to agitate the liquid within the tub upon oscillation of the agitator for effecting the washing operation. The agitator is further provided with a hollow center post or pedestal 94 disposed on the vertical axis of the tub which extends upwardly from the lower portion of the tub above the normal liquid level therein. This centerpost is formed with an inner compartment or float chamber 96 having an upper open end facing in the direction of the lid and communicating with the interior of the tub 8 through one or more openings 98 extending radially through the wall of the center post adjacent the bottom of the chamber. A float 100 is loosely carried in this float chamber to permit longitudinal sliding movement therein in accordance with the liquid level within the tub and chamber 96 for operating the control mechanism 14 with a minimum of friction.

As previously mentioned, the material introduced into the receptacle is subjected to a washing action through the oscillating action of the agitator and is also subjected to centrifuging action whereby the same is spin-dried upon the rotation of the tub. In order to rapidly rotate the tub 8, suitable clutch mechanism 102 may be provided for effecting a driving relation between the inner shaft 40 and the outer tubular shaft 42.

Means are provided in the form of a brake mechanism 104 secured in part to the stationary tub 6 and to the outer shaft 42 for holding the tub 8 stationary during the washing operation and for permitting the rotation of the tub during the spinning operation. The operation of both the brake 104 and clutch 102 is under control of a solenoid 106 (Figure 4) which when de-energized applies the brake and renders the clutch inactive and when energized releases the brake and engages the clutch to connect the inner and outer shafts together to drive the same in unison.

The damper housing 88 which provides a support at least in part for the clutch and brake

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mechanisms and has the centering springs connected thereto, is also provided at its uppermost end with a spherical surface 107 having dampening material 108 attached thereto which is positioned to engage the crowned portion 39 of the stationary tub 6. This dampener is provided to reduce the amplitude of lateral movement of the receptacle 8 during the spinning operation.

A clutch, centering means, brake and damper mechanisms suitable for effecting the above operations is described and claimed in my co-pending application Serial No. 66,230, filed December 20, 1948, now Patent No. 2,645,108, issued July 14, 1953, and assigned to the assignee of the present invention. It is to be understood, however, that said application discloses but one form of such mechanisms suitable for operating the washing machine as herein disclosed and that other suitable types may be utilized.

Hot and cold washing liquid or water are supplied from conduits 109 and 110 (Figure 4) to the thermostatically controlled mixing valve 27 which discharges the water at the proper temperature into a conduit 111 extending upwardly between the cabinet and the outer tub 6, the same being connected at its upper end (not shown) to an inlet spout or nozzle 112 extending laterally through an opening in the upper part of the tub 6 to discharge the washing water into the rotatable tub 8.

The hollow lid 22 housing the control mechanism 14 has its lower wall section 114 formed with an aperture or opening 116 disposed directly above the upper open end of the center-post 94 and through which a control button 118 on the control mechanism 14 loosely projects. This control button is preferably secured adjacent one end of a lever 120 which is pivoted at its opposite end 122 to a pin carried by the lower wall section. A bracket 124 is pivotally mounted above the lever 120 on a pivot 126 and provides a support for a pair of control switches 128 and 130 of the mercury type whose longitudinal axes are displaced with respect to each other and whose contacts 132 and 134 are oppositely disposed. This bracket is movable about its pivot point 126 by the lever 120 when the same is moved by the float 100.

The details of construction of the entire switch assembly 14 including an unbalance safety switch and the operation therefor in an apparatus of the type herein disclosed, is more fully described in the co-pending application of Thomas R. Smith and Dudley P. Combs, Serial No. 64,792, filed December 11, 1948, now Patent No. 2,612,766, issued October 7, 1952, and assigned to the assignee of the present invention.

Referring now more particularly to Figures 1, 2 and 3 for a more complete disclosure of the details of construction of one form of a centrifugally operated valve mechanism mounted in the rotatable tub 8 which is actuated when the tub is rotated to permit self-cleaning or flushing of heavy particles of dirt which have collected in the sediment space or zone 63 between the bottom of the basket 58 and bottom 48 of the receptacle, there is shown the substantially imperforate receptacle 43 which includes the horizontal bottom wall 48 and slightly upwardly and outwardly flaring cylindrical side wall 45, with the inner periphery of the lower portion of the side wall 45 tapered slightly at 47 toward the bottom wall 48. This slight downward taper directs a portion of the liquid entering the annular space 62 between the side walls of the re-

ceptacle and basket toward the passage 52 when the valve is open. The integral outwardly projecting lugs 50 disposed about the lower portion of the side wall 45 extend radially outwardly beyond the periphery of the side wall in parallel spaced relation with respect to the similarly located lugs 51 on the bottom wall and they are placed in alignment with respect to each other. Disposed between the lugs 50 and 51 are the spacing elements 49 which act as means for holding the bottom of the side wall 45 and the bottom wall 48 in spaced relation to define the annular opening or circumferential discharge passage 52. It can be seen from the drawings that this passage is unobstructed and in direct communication with the sediment zone 63 and annular space 62. In order to secure the side wall 45 and the bottom 48 of the receptacle 43 together to provide a single unitary structure the spacing elements 49 have their ends 136 reduced in diameter and threaded so that they project through mating openings 133 in the lugs 50 and 51 on which nuts 140 are threaded. The shoulders 142 on the spacing elements 49 insure the proper thickness of the circumferential discharge passage 52 and locate the sealing edge 144 on the side wall 45 and the sealing edge 146 on the outer periphery of the bottom wall 48 in proper alignment. It is to be understood, however, that other spacing and bolting means may be employed to obtain the same results.

With a construction of this type the combined spacing elements 49 and bolts are disposed beyond the outer periphery of the centrifugally operated resilient valve or O ring sealing means 53, thus permitting the liquid pressure to act uniformly on the entire sealing ring when the tub is rotated and at the same time presents a uniform seating surface for the sealing ring when the tub is stationary. In addition, the spacing elements provide a means for limiting the radially outward movement of the resilient O ring when it is moved outwardly by centrifugal force and the parallel spaced lugs act as guides for the spacing ring to maintain it opposite the discharge passage, should it tend to move vertically out of position, and to direct it back to cover the same when the speed of rotation of the tub drops below a predetermined value. The diameter and thickness of the sealing ring and its modulus of elasticity is so selected as to insure seating and sealing at the edges 144 and 146 on the outer periphery of the tub when the tub is stationary or rotating at relatively low speeds, and that it will stretch or yield when rotated above a predetermined speed away from the sealing edges 144 and 146 to open the discharge passage. In addition, in actual operation the resilient ring being unsupported between the spacing elements tends to bow outward as shown in dot and dash lines in Figure 3. This, however, merely opens the passage further and does not affect the effectiveness of its operation.

When the tub 8 is stationary during the washing operation the liquid within the basket 44 is agitated rather violently by the agitator 10 and due to this action a portion of the liquid is circulated through the space 62 between the basket and receptacle 43 through the openings 60 in the basket 44. The water entering the space carries with it heavy dirt and other foreign particles which tend to collect or settle on the top surface of the base member in the sediment zone 63 because the liquid in this space has a tendency to be relatively quiet. Thus, the foreign particles

are restricted or retarded therein while the liquid flows back into the interior of the basket through the openings 60 in the side wall and these particles of heavy dirt for the most part will remain in this space.

After the washing operation the tub is rotated to centrifugally extract the liquid therefrom. Centrifugal force will cause some of the water to flow up the annular space 62 out of contact with the fabrics being washed and over the top edge 46 of the tub. As the speed of rotation of the tub reaches a sufficiently high value, centrifugal force acting on the resilient ring or valve 53 plus the increased hydrostatic head of water acting on the exposed area of the valve causes the same to move radially outwardly to its open position against the spacing elements 49 as indicated by the dot and dash lines. When this valve opening occurs it will be rather rapid and due to the relatively high speed of rotation of the tub a relatively large quantity of water will be expelled centrifugally through the circumferential discharge passage around the resilient sealing ring into the stationary tub 6. Simultaneous with this, a portion of the liquid is rapidly drawn through the openings 60 in the bottom of the basket and through the space 65 at the bottom of the agitator and around the inner edge 64 into the sediment zone 63, which acts to flush or clean the top surface of the bottom wall 48. This water action tends to pick up or move the major portion of the foreign particles settled thereon and discharges the same through the passage 52 into the stationary tub 6 wherein it is directed to the drain outlet 36. When the extraction operation is terminated and the speed of rotation of the tub decreases below a given value the natural resiliency in the toroidal sealing ring or valve 53 causes the same to move inward to its original position to seal the circumferential opening 52 to prevent water from flowing therethrough. Should the sealing ring have any tendency to shift, for any reason, the parallel sides of the lugs 50 and 51 will direct it to its proper position.

With a construction of this type it can be seen that the sediment zone 63 provided in the bottom of the tub is in effect self-cleaning whenever the tub is rotated. Also, the perforate basket retains the clothes and the liquid entering the space 62 through the openings 60 in the basket is rapidly discharged without contacting the fabrics being washed.

The operation of the automatic washing machine of the type hereinabove described and incorporating a centrifugally operated valve mechanism in the lower portion of the rotatable tub 8 made in accordance with the invention is as follows:

The operator opens the lid 22 and then places the clothes and fabrics to be washed through the opening 18 into the interior of the basket 44 including with it the proper quantity of detergent, and the lid is closed. Thereupon the operator decides whether to use hot or warm water for the washing operation and adjusts the temperature control knob to position a movable contact 148 in an electrical circuit 150 to either engage a warm water contact 152 in a circuit 154 to energize the warm water valve 156, or to engage a hot water contact 158 to energize the hot water valve 160 through a parallel circuit 162, when the appropriate cam 164 on the timer is advanced to complete the circuit 150 from L₁ to L₂. For example, if the operator desires hot water, the

contact 148 is placed in engagement with the hot water contact 158 and the circuit 162 is conditioned for operation.

Next the operator grasps the timer control knob 25 and turns the same to the desired washing period and closes the main line switch 166 which conditions the timer motor 29 for operation and lights the pilot light 165 to indicate that the washing machine circuit is energized. Upon turning of the timer control knob the hot water side of the thermostatically controlled valve 27 is actuated and conducts water at the proper temperature to the rotatable tub 3 through the inlet nozzle 112. As the water level in the tub rises above the opening 92 in the centerpost 94 the water flows therethrough into the float chamber 96 to raise the float 109 from its inactive position. After the float is moved vertically a sufficient distance the top of the float contacts the button 118 on the lever 120 and raises the same about its pivot point 122 which in turn tilts the bracket 124 about its pivot 126 to tilt the mercury switches 128 and 130. When the liquid in the tub reaches a predetermined level the mercury switch 130 is actuated so that the mercury bridges the contacts 134 therein to energize the timer motor 29 and main drive motor 76 through circuit 170 and the appropriate cams to start the washing operation by oscillating the agitator 10 through the oscillating mechanism 72 and to advance the cams 28 intermittently on the timer. Shortly thereafter the switches are tilted still further by an increase in the water level and the mercury in the switch 128 moves away from the contacts 132 to deenergize the water supply circuit 150 and the flow of water to the receptacle through the valve 27 is interrupted, at which time the proper quantity of water for the washing operation has been introduced into the tub 8.

During the washing operation heavy particles of foreign matter and dirt are carried by the washing liquid through the openings 60 in the bottom of the basket 44 wherein the major portion tends to settle in the sediment collecting zone 53 due to the less violent circulation of the liquid. After a predetermined period of agitation, the timer, advancing the cams 28 completes the circuit 172 which energizes the brake solenoid 106 to release the brake 104 holding the tub 8 from rotary movement and at the same time causes the clutch 102 to be engaged to directly connect the continuously rotated drive shaft 40 to the hollow rotatable shaft 42 carrying the receptacle to rotate the same, at which time no relative movement takes place between the agitator and tub. Also, the two mercury switches 128 and 130 are cut out of the control circuit by means of the cams 28 on the timer which controls the same.

As the tub is accelerated by the drive motor 76, a portion of the washing liquid is centrifugally discharged from the same through the annular space between the imperforate side wall 45 of the outer receptacle 43 and over its top edge 46 into the stationary tub 6. Prior to attaining full speed of rotation the centrifugally operated resilient annular sealing ring 53 in the lower portion of the tub 8 is moved radially outwardly away from the circumferential discharge passage 52 against the spacing elements 49 by means of centrifugal force and the increased hydrostatic pressure of the liquid acts thereon to permit a relatively large quantity of water at relatively high velocity to flow through the open-

ings 60 in the bottom wall 58 of the basket and around the inner edge 64 into the sediment space 63 and out of the circumferential passage 52 into the stationary tub 6 to thereby remove the foreign particles therefrom.

At full speed of rotation the sealing ring is held open against the spacers 49 and a major portion of the washing liquid is removed from the fabrics in the basket. During this time a flush rinse of clear, warm water is admitted to the tub through the inlet nozzle 112 by actuation of the cam controlling the warm water to complete the circuit 154 through the warm water control valve 27 to remove a portion of the remaining soapy water in the fabrics.

As the timer motor reaches the end of the spin period the cam for energizing it is moved to deenergize the timer motor 29 and the drive motor 76 and deenergize the brake solenoid 106 so that it is actuated to apply the brake 104 and release the clutch 102 to stop and hold the tub 8 stationary. At the same time the natural resiliency of the centrifugally operated valve 53 causes it to move back to cover and seal the circumferential passage 52 against leakage. Simultaneously with this action the warm water valve is energized again by its cam through its circuit 154 and warm water is admitted to the tub through the nozzle 112, and upon attaining the proper level therein the switches 128 and 130 are tilted in a manner identical to that previously described to again actuate the timer and drive motors and to interrupt the supply of liquid to the tub and to initiate the agitate rinse.

The operation of the washing machine during the agitating rinse period is identical to the operation thereof during the washing period except it is of shorter duration, after which the cams 28 are advanced to interrupt the agitating rinse period and the tub is again rotated as above described to remove the rinse water from the fabrics being washed and to discharge the same through the drain opening 36. Also, at the same time a portion of the rinse water is centrifugally forced through the openings 60 in the bottom of the basket, the sediment space 63 and the circumferential discharge passage 52 to clean or remove any remaining foreign particles in the space in an identical manner as previously described.

At the end of the final spin period, as determined by the location of the cams on the timer, the timer motor is deenergized simultaneously with the drive motor and the brake solenoid is deenergized to reapply the brake to the receptacle to stop the same. During this washing cycle the fabrics have been washed with detergent, rinsed in clear water and have had a large portion of the water removed therefrom. The washing operation is now completed, and the operator need only raise the lid and remove the fabrics from the tub.

From the foregoing, it can be seen that a centrifugally operated valve has been provided for a sediment trap or zone formed adjacent the lower portion of a rotatable tub of a washing machine which is operable when the tub is rotated at relatively high speeds to uncover a circumferential passage in communication with the sediment trap to thereby permit a relatively large quantity of water to flow therethrough to remove heavy dirt and foreign particles from the trap and that this operation provides in effect a self-cleaning sediment trap.

While I have herein described and upon the

drawings shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto but may comprehend other constructions, arrangements of parts, details and features without departing from the spirit of the invention.

It is claimed:

1. A rotatable tub for a washing machine adapted to receive liquid and materials to be washed, comprising a bottom wall, a side wall having an edge spaced from said bottom wall to define an unobstructed circumferential discharge passage, spacing means disposed exteriorly of said side wall for rigidly holding the edge of said side wall and said bottom wall in spaced relation, and an annular resilient sealing ring disposed between the outer periphery of said tub and said spacing means to seal said passage when said tub is rotated below a predetermined speed, and the entire ring being movable by centrifugal force to uncover the passage when said tub is rotated above a predetermined speed, said spacing means acting to stop the outward movement of said ring.

2. A rotatable tub for a washing machine adapted to receive liquid and materials to be washed, comprising a bottom wall, a side wall having a lower edge spaced from said bottom wall and an upper open end defining a top edge over which liquid is discharged when said tub is rotated, spacing means disposed exteriorly of said side wall and in contact with said bottom wall to rigidly hold the lower edge of said side wall in spaced relation to said bottom wall to define an unobstructed circumferential discharge passage therebetween, and an annular resilient sealing ring having a portion normally sealing said passage when said tub is stationary disposed between the outer periphery of said tub and said spacing means, and the entire ring being movable by centrifugal force to uncover the passage when said tub is rotated above a predetermined speed, said spacing means acting to stop the outward movement of said ring.

3. A rotatable tub for a washing machine adapted to receive liquid and materials to be washed, comprising a generally flat wall, a generally cylindrical wall having one edge spaced from said flat wall to define an unobstructed circumferential discharge passage, spacing means secured to said flat wall and said cylindrical wall exteriorly thereof for rigidly holding the walls in spaced relation, and an annular resilient sealing element disposed between the outer periphery of said cylindrical wall and said spacing means to seal said passage when said tub is rotating below a predetermined speed and operable by centrifugal force to uncover said passage when rotated above said speed, said spacing means being so disposed as to limit the outward movement of said sealing element.

4. In a washing machine, the combination of a rotatable tub for receiving liquid and materials to be washed, said tub having a bottom wall and a side wall with a lower edge and an upper open end defining a top edge over which liquid is discharged when said tub is rotated, spacing means exteriorly of said tub for rigidly holding the lower edge of said side wall in spaced relation to said bottom wall to define an unobstructed circumferential liquid discharge passage therebetween, an annular resilient sealing ring having a portion normally sealing said passage disposed between the outer periphery of said tub and said spacing means, and drive means for rotating said tub.

5. In a washing machine, the combination of a

rotatable tub for receiving liquid and materials to be washed, said tub having a bottom wall and a side wall, spacing means disposed exteriorly of said tub for rigidly holding the bottom edge of said side wall and said bottom wall in spaced relation to define an unobstructed circumferential liquid discharge passage therebetween, drive means for rotating said tub, and an annular resilient sealing ring having a portion normally sealing said passage disposed between the outer periphery of said tub and said spacing means.

6. In a washing machine, the combination of a rotatable tub for receiving liquid and materials to be washed, said tub including a side wall and a bottom wall, spacing means disposed about the outer periphery of said tub for rigidly holding said side wall and bottom wall in spaced relation to define an unobstructed circumferential discharge passage therebetween, drive means for rotating said tub, and an annular resilient sealing element disposed between the outer periphery of said tub and said spacing means to seal said passage when said tub is stationary and movable by centrifugal force to uncover said passage when said tub is rotated.

7. A washing machine for receiving liquid and fabrics to be washed, comprising a tub mounted for rotation about a vertical axis, drive means for rotating said tub about its vertical axis, said tub including an imperforate side wall having a lower edge and an imperforate bottom wall, spacing means disposed about the outer periphery of said side wall for rigidly holding the lower edge of said side wall and bottom wall in spaced relation to define an unobstructed circumferential discharge passage, means for securing said side wall and bottom wall to form a unitary structure, and an annular resilient sealing element disposed about the outer periphery of said tub to cover said passage when said tub is rotated below a predetermined speed and to uncover said passage when said tub is rotated above said speed, said sealing element being positioned between said passage and said spacing means.

8. A rotatable tub for a washing machine adapted to receive liquid and fabrics to be washed, comprising a receptacle having a substantially cylindrical side wall with a lower edge and a generally horizontal bottom wall, spacing elements disposed about the outer periphery of said receptacle for rigidly holding the lower edge of said side wall and bottom wall in spaced relation to define an unobstructed circumferential discharge passage, means including the spacing means for securing said side and bottom walls together to provide a unitary structure, a container secured to said receptacle and having its bottom wall spaced from the bottom wall of said receptacle to define a sediment zone in direct communication with said passage, and an annular resilient sealing ring disposed between said spacing elements and the outer periphery of said receptacle and freely mounted with respect to said receptacle to seal the passage when said tub is rotating at relatively low speeds and to uncover said passage when said tub is rotated at relatively high speeds, said spacing elements being positioned to limit the outward movement of the sealing element when said tub is rotated.

9. In a washing machine, the combination of a rotatable tub adapted to receive liquid and fabrics to be washed, said tub including a side wall with a lower end and a bottom wall, radially outwardly extending integral lugs disposed adjacent the lower end of said side wall and the outer

periphery of said bottom wall, spacing elements disposed between said lugs for rigidly holding the lower end of said side wall and bottom wall in spaced relation to define an unobstructed circumferential discharge passage, means for securing said lugs and spacing elements together to provide a unitary structure, a container disposed within and secured to said tub and having its bottom wall spaced from the bottom wall of said tub to define a sediment zone in direct communication with said passage, means for rotating said tub, and an annular resilient sealing ring disposed between said spacing elements and freely mounted with respect to said tub, radial lugs and the outer periphery of said tub to seal said passage when said tub is rotated below a predetermined speed and to uncover said passage when said tub is rotated above said speed, said spacing elements and lugs acting to limit and direct the movement of said sealing element when said tub is rotated.

10. In a washing machine, the combination of a rotatable tub for receiving washing liquid and materials to be washed, said tub including an imperforate base member and a side wall having its upper edge extending above the normal liquid level therein and over which liquid is discharged when said tub is rotated, said side wall having its major portion flaring upwardly toward said upper edge and a minor portion flaring downwardly toward said base, parallel spaced lugs disposed radially outwardly about the lower portion of said side wall and base, spacing elements disposed between said lugs exteriorly of said side wall, means for rigidly securing said side wall to said base in spaced relation through said spacing elements to provide a unitary structure and to define an unobstructed circumferential discharge passage therebetween, a perforate basket for receiving materials to be washed secured in said tub and arranged with respect thereto to define an unobstructed liquid conducting space therebetween in communication with said circumferential passage, the lower portion of said space providing a sediment zone for heavy particles of foreign matter, and an annular resilient sealing ring disposed between said spacing elements and the outer periphery of said tub and freely mounted with respect to said tub for sealing said passage

during the washing operation and operable under centrifugal force to open the same to permit a portion of the liquid in said tub to flow through the lower portion of said space to flush the heavy particles of foreign matter therefrom through said passage, said spacing elements defining a stop to limit the outward movement of said sealing ring when said tub is rotated.

11. A rotatable tub for a washing machine adapted to receive liquid and materials to be washed and wherein a washing operation and a drying operation is performed, comprising an outer tub having a bottom wall and an upwardly flaring side wall with its lower edge spaced from said bottom wall to define an unobstructed circumferential discharge passage thereabout and being imperforate elsewhere, means for securing said side wall to said bottom wall exteriorly thereof to provide a unitary structure, an inner tub secured in said outer tub in spaced relation thereto to provide a liquid conducting space therebetween and a sediment zone in the lower portion thereof in direct communication with said circumferential discharge passage, and an annular resilient sealing ring disposed between said securing means and the outer periphery of said outer tub to seal said circumferential passage during the washing operation and movable outwardly by centrifugal force when the tub exceeds a predetermined speed to uncover said passage to permit liquid to flow therethrough from the sediment zone to flush the same, said securing means being disposed to limit the outward movement of said sealing element.

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