

T. R. SMITH
WASHING MACHINE WITH ROTATABLE TUB HAVING
A CENTRIFUGALLY OPERATED VALVE

3 Sheets-Sheet 1

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3 Sheets-Sheet 2

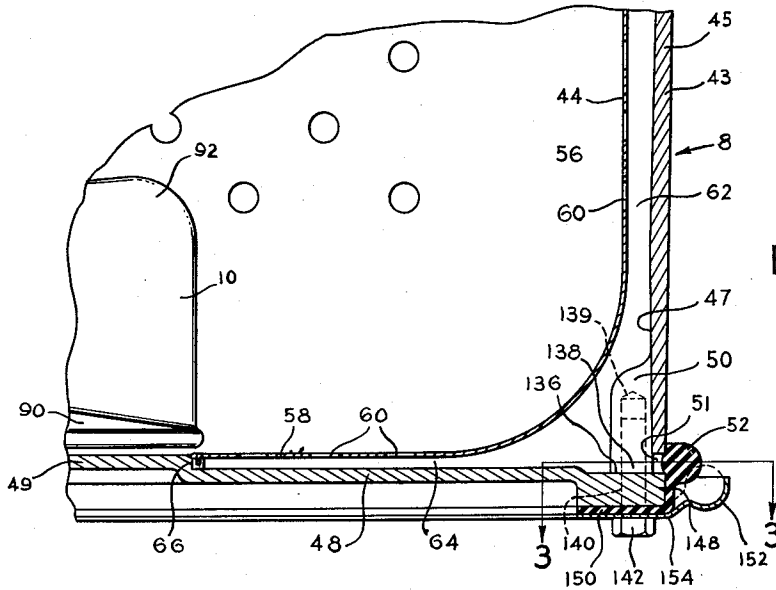


FIG. 2

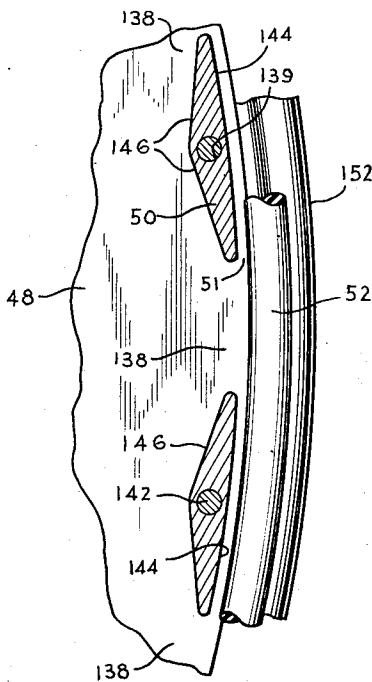


FIG. 3

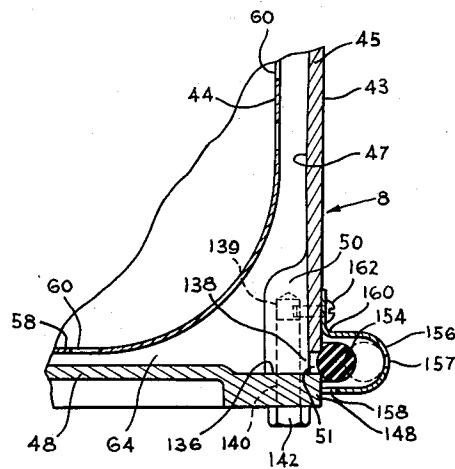


FIG. 4

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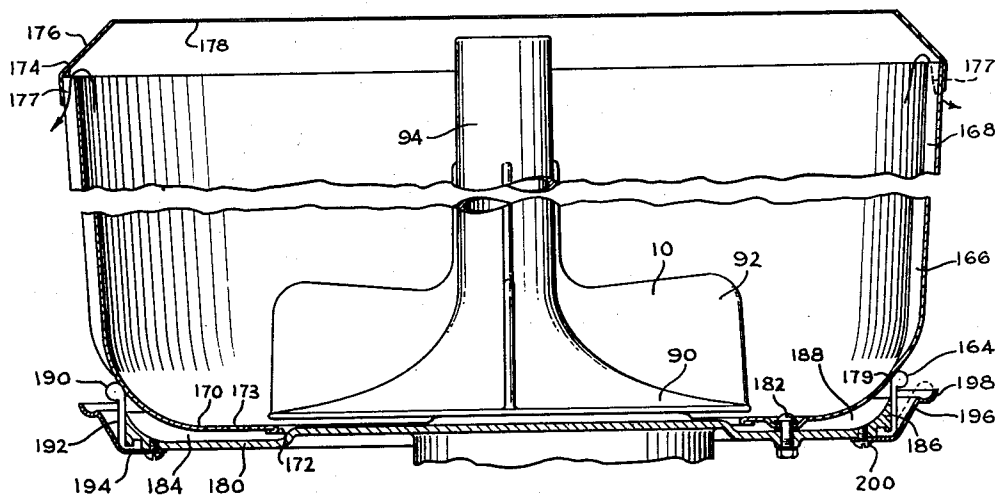
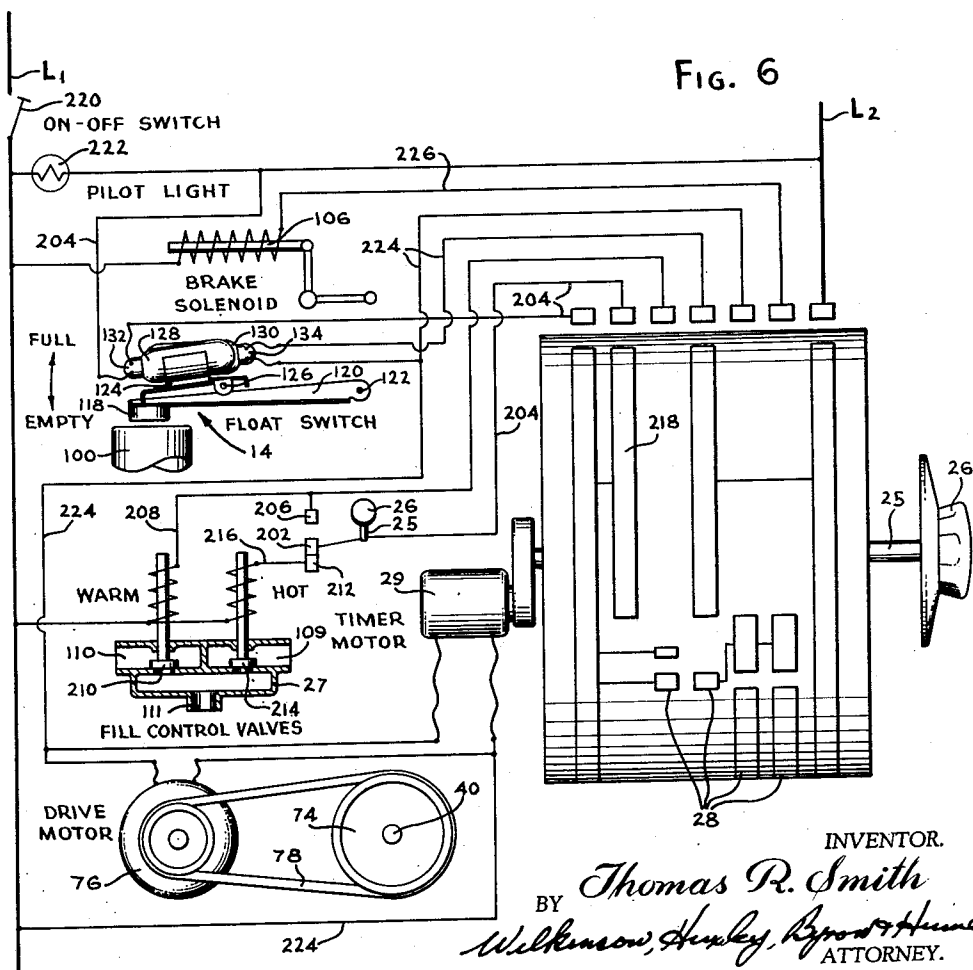


FIG. 5



UNITED STATES PATENT OFFICE

2,641,918

WASHING MACHINE WITH ROTATABLE TUB
HAVING A CENTRIFUGALLY OPERATED
VALVEThomas R. Smith, Newton, Iowa, assignor to The
Maytag Company, Newton, Iowa, a corporation
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Application June 3, 1949, Serial No. 97,012

15 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 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 centrifugal 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 with 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 another 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 with means 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 still 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 dirt particles during the washing operation and centrifugally operated resilient valve means disposed about a passage in the periphery of the tub capable of preventing leakage when the tub is stationary and which is opened by centrifugal force and the pressure of the liquid when the tub is rotated at relatively high speed to permit a direct flushing action of water through the space to remove the particles 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 will later appear and as are inherently possessed thereby.

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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 vertical sectional view showing more in detail the construction of the lower portion of the rotatable tub 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 line 3—3 of Figure 2 of the drawings showing the passage through the lower portion of the tub and the annular centrifugally operated valve means;

Figure 4 is a partial vertical sectional view similar to Figure 2 showing a modified construction for the centrifugally operated valve means and the guard therefor;

Figure 5 is a broken vertical sectional view of still another modification showing a modified tub construction with a centrifugally operated valve means applied thereto; and,

Figure 6 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-

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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 lid into or out of its closed position. In this instance, the top panel is apertured adjacent a front corner thereof, which aperture 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 6 of the drawings.

The outer stationary tub 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 a centrally disposed enlarged opening 38 in a centrally located crowned portion 39 through which vertical coaxial 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 in this modification it is formed in two sections or parts 43 and 44. The outer part 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 having a major portion thereof tapering slightly toward the open end which terminates in a top edge 46 adapted to extend above the normal liquid level desired for washing. The lower portion of the side wall 45 is tapered slightly at 47 toward a generally horizontal bottom wall 48 formed with a centrally disposed hub 49 and is spaced therefrom by means of a plurality of spaced inwardly and downwardly projecting lugs 50 formed integral with the lower portion of the side wall to define an annular circumferential passage 51 therebetween. This passage is sealed against liquid flow when the tub 8 is stationary by means of an annular resilient centrifugally operated valve member 52 in a manner to be hereinafter described.

Projecting through and upwardly from the hub 49 is a vertically disposed oscillatable shaft 54 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 49 and the shaft 54 to provide a fluid-tight joint.

The inner part 44 of the rotatable tub 8 is in the form of an open ended cylindrical basket having the lower portion of its side wall 56 and the bottom 58 perforated at 60 and disposed in substantially parallel spaced relation with the

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sidewall 45 and the bottom 48 of the substantially imperforate receptacle 43 to provide a 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 disposed between the bottom portion 58 of the basket and upper surface of the bottom wall 48 of the outer part 43 is utilized as a sediment trap 64 and it tends to restrict the recirculation of heavy dirt and foreign particles back into the materials being washed in a manner to be hereinafter described.

The basket 44 may be secured to the receptacle 43 in any suitable manner, such as, for example, by screws 65, and its lower innermost portion is provided with a suitable resilient gasket and is centered by means of a raised shoulder portion 66 on the hub 49 adjacent the outer periphery of the agitator 10. The upper portion of the basket is imperforate and extends upwardly and inwardly above the normal liquid level and terminates to define an opening 67 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.

In this particular construction the upper portion of the basket 44 has mounted thereon a hollow toroidal balancing member or ring 68 preferably containing a mobile material 69, 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 load conditions.

Means for oscillating the agitator 10 are provided by suitable oscillating mechanism generally indicated at 70 which, in this construction, is carried in a gear housing 72 disposed at the bottom and bolted to the rotatable tub 8 to increase the mass thereof. This oscillating mechanism is preferably directly operated by the inner vertically disposed rotatable shaft 40 which has a driven 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 72 is further provided with a downwardly projecting hub portion 80 concentric with the shaft means and rigidly secured to the upper end of the outer tubular shaft 42 by means of pins 81, while the lower end of the shaft means 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 hollow 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 86 having upper and lower sealing surfaces adapted to engage 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

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16. Accordingly, means is 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 83 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 6 and the opposite ends are connected to a damper housing 84 disposed adjacent to and beneath the bottom 34 of the stationary tub 6. This damper housing is also disposed concentric 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 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 hub above the normal liquid level within the tub. This center post 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 a centrifuging action whereby the same is spin-dried upon the rotation of the tub. In order to rapidly rotate the inner tub, suitable clutch mechanism 102 may be provided for effecting a driving relation between the inner shaft 40 and the outer 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 6) which when deenergized 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 84 which provides a support at least in part for the clutch and brake 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

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mechanisms suitable for effecting the above operation are described and claimed in my co-pending application Serial No. 66,230 filed December 20, 1948, 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 6) 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 and opening in the upper part of the tub 6 to discharge the washing water into the rotatable receptacle 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 in the center-post 94 and through which a control button 118 on the control mechanism 14 loosely projects.

This control button 118 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. This bracket is movable about its pivot point 126 by the lever 120 when the same is moved by the float 100. The mercury switches mounted with their longitudinal axes disposed in offset relation with respect to one another have their contacts 132 and 134 oppositely disposed as more clearly shown in Figure 6 of the drawings. As shown in Figure 1 of the drawings, the button 118 is in its lowermost position, indicating that the liquid is at such a low level as to be ineffective to raise the float.

With the switches and contacts disposed as mentioned above it can be seen that when the bracket 124 is in one position the contacts of one of the switches are bridged by the mercury contained therein, whereas the contacts are not bridged by the mercury in the other switch. When the bracket is moved to its other position the opposite action takes place, in that the mercury in the first mentioned switch moves away from the contacts and the mercury in the other switch moves to bridge the contacts to complete a circuit therethrough. The results accomplished by angularly disposing the switches with respect to each other, the positioning of the contacts and their operation in the control circuit will be more fully described hereinafter.

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 on 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 space 54 between the bottom of the basket 58 and the bottom wall 48 of the tub, there is shown the substantially imperforate receptacle 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. The integral spaced lugs 50 extend downwardly beyond the bottom edge of the side wall and the bottom surface 136 of each of the lugs is adapted to engage the upper surface of the bottom wall 48 to provide a plurality of spaced passages 138 between the vertical portion of the lugs which lead to the annular opening or circumferential discharge passage 51. Some or all of these lugs are tapped as at 139, through their lower surfaces 136 in alignment with mating openings 140 about the outer edge of the bottom wall 48 to receive bolts 142 whereby the bottom and side walls are secured together to provide a rigid unitary structure.

Each of the integral inwardly and downwardly projecting combined lugs and spacers has its outer peripheral portion 144 in approximate alignment with the inner periphery 47 of the side wall 45 to provide for the annular circumferential discharge passage 51. This spacing permits the liquid pressure to act uniformly on the entire sealing ring 52 when the tub is rotated and at the same time provides a uniform seating surface therefor. In addition to the spacing of the lugs from the outer periphery of the side wall, the lugs 50 are preferably elongated circumferentially about the tub to provide a pair of relatively wide and flat outwardly tapering inner surfaces 146. By elongating the lugs in this manner, the tendency of particles of lint or pieces of string-like fabric to wrap or become snared about the lugs is reduced, because the increased surface will tend to cause a large portion of the material to move in one direction or the other through the passages 138 when the tub is rotated and not wrap about the lugs and extend outward from both sides thereof through the discharge passage 51.

The centrifugally operated toroidal resilient ring or valve 52 is positioned about the outer peripheral portion of the base to seal the annular passage 51 against the flow of liquid therethrough by being in contact with the lower edge of the side wall 45 and the upper outer marginal edge 148 of the bottom wall 48. The diameter of the ring and modulus of elasticity is so selected as to insure seating when the tub is stationary and that it will stretch or yield when rotated above a given speed. This toroidal ring is further provided with an integral downwardly and then inwardly extending flange 150 which is clamped to the bottom wall by means of the bolts 142 to hold and guide the same when the tub is rotated. In addition to the flange 150 for holding the ring 52 there is provided an annular cup-shaped guard or stop device 152 having a horizontal inwardly extending flange 154 adapted to overlie the resilient flange 150 and it is also clamped to the base by the bolts 142. The outer portion of the stop device 152 is generally shaped to conform to the contour of the outer surface of the ring 52 and flange 150 to support the same when stretched by centrifugal force, as shown in dot and dash lines in Figure 2. This stop prevents the resilient ring from passing through its dead center posi-

tion and not returning to its seat when rotation of the tub is terminated.

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 settle on the top surface of the base member because the liquid in this space has a tendency to be relatively quiet. Thus, the foreign particles are restricted or retarded in their flow back toward the inner portion of the basket and since the liquid in this space is not unduly agitated, these particles 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 force some of the water up over the top edge 46 of the tub and when the speed of rotation reaches a sufficiently high value, centrifugal force acting on the resilient ring or valve 52 plus the increase in hydrostatic head of the water acting on the exposed area of the valve causes the same to move radially outwardly to its open position against the stop 152 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 outward between the passages 138 through the circumferential opening 51 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 into the space 64 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 which have settled on the bottom wall 48 and discharges the same through the opening 51 into the stationary tub 6 wherein they are 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 ring shaped valve 52 causes the same to move inward to its original position and seal the circumferential opening 51 to prevent water from flowing there-through.

With a construction of this type it can be seen that the sediment space 64 provided in the bottom of the tub is in effect self-cleaning whenever the tub is rotated.

Referring now to Figure 4 there is disclosed a modified form of centrifugally operated ring shaped valve construction 154. The tub assembly including the basket 44, bottom 48 of the receptacle 43, its vertical side wall 45, circumferential discharge passage 51 and the means for securing these elements in spacing relation is identical to the tub assembly shown in Figures 1, 2 and 3 of the drawings. In this instance, the ring shaped valve 154 is not provided with any integral anchoring means; however, there is provided an annular metallic C-shaped guide and stop device 156 having a plurality of openings 157 in the outermost part and the lower portion of the clamp is spaced from the outer marginal edge 148 of the bottom wall 48 to define an opening 158 for the flow of liquid discharged from the circumferential passage 51 when the tub is rotated. The clamp and guide device 156 is further provided with an upwardly extending flange

portion 160 disposed adjacent the outer wall 45 and secured thereto by means of a plurality of bolts 162. The operation of this valve is identical to the previously described modification in that when the speed of rotation reaches the proper value, centrifugal force acting on the resilient ring and the static head developed by the liquid forces the valve into its open position, as shown in dotted lines, to permit a portion of the water being extracted to flow through the circumferential passage 51 and the opening 158 in the bottom of the guide 156 to thereby remove heavy particles of dirt from the sediment trap 64 at the lower portion of the tub 8.

In the construction shown in Figure 5, although the operation of the centrifugally operated valve 164 is identical to the other modifications, there is shown a modified form of tub construction 166 to which a valve of this type is applicable. In this instance the rotatable tub 166 is provided with an imperforate upwardly and outwardly flaring fluted side wall 168 preferably generally circular in horizontal cross-section and having a generally horizontal bottom wall 170, apertured at 173, and terminating adjacent the periphery of the agitator 10 to provide an annular space 172 in communication with the underside of the agitator. The upper edge 174 of the fluted side wall extends above the normal desired liquid level in the tub and during rotation of the same the liquid moves upwardly along the side wall and is directed downwardly by an imperforate cover 176 secured to the upper end of the side wall and out of a plurality of passages 177 formed by the flutes into the stationary tub as shown by the arrow. The cover 176 for the side wall extends upwardly and inwardly with an opening 178 at its upper part to permit access to the interior thereof and, if desired, to provide supporting means for the balancing ring 68 shown in Figure 1. The fluted portion of the side wall terminates adjacent the lower portion of the tub where it curves inwardly at 179 to form the horizontal bottom portion 170.

Disposed below the bottom of the tub is a radially extending horizontal plate or base member 180 which supports the tub 166 in spaced relation thereto by means of a plurality of bolts 182 extending through openings in depressed portions in the tub bottom mating with openings in the base member to define a settling space or sediment trap 184 directly below the openings 173.

In order to provide suitable means for carrying the sealing ring 164 the base member 180 has its marginal edge thickened at 186 which in this modification is in an upwardly direction so that its upper end is spaced from the lower and outer curved portion 179 on the tub to define a circumferential discharge passage or opening 188 adapted to be covered by the annular resilient sealing ring or valve 164. It can be seen that this passage is in direct communication with the sediment trap 184 so that liquid may be discharged therethrough into the stationary tub 6 when the inner tub is rotated above a predetermined speed.

As in the first modification, the annular resilient sealing ring or valve 164 comprises a toroidal sealing member 190 formed from any suitable resilient material, such as rubber or the like, adapted to normally contact both the curved portion 179 on the tub and upper marginal end 186 of the disc when the tub is stationary to seal the passage 188. This sealing member is provided with an integral downwardly and then inwardly

extending resilient anchor or flange portion 192 closely fitting the periphery and outer portion of the lower wall of the base member 180. To insure the positioning of the valve under all conditions of operation the inner edge of the flange is provided with an enlarged portion 194 adapted to fit into an under-cut in the lower wall of the base member.

A guard ring 196 having its upper outer portion 198 spaced from the outer portion of the centrifugally operated valve 164 permits the valve to open under centrifugal force, but prevents it from moving too far beyond its open position to thereby insure that the valve will return to seal the opening 188 when the tub is stopped or its speed reduced. In addition, the lower portion of the guard ring is provided with an inwardly directed flange which acts to clamp the lower end of resilient flange 192 in position by means of screws 200.

It should be clear from the above described construction that during the washing operation the heavy particles of dirt and foreign particles will tend to settle in the sediment trap 184 by passing through the openings 173 in the horizontal wall 170 of the tub 166. As the tub is rotated liquid will flow over the top edge 174 of the side wall 168 and when the speed of rotation is sufficiently high centrifugal force acting on the resilient sealing ring 164 plus the increased hydrostatic pressure of the liquid causes the valve to open, at which time a portion of the liquid in the tub 166 flows through the openings 173 in the bottom wall 170 of the tub into the sediment trap, picks up or carries along with it the heavy dirt particles and discharges the same through the circumferential discharge passage 188 into the stationary tub 6, wherein the liquid is directed to the outlet drain 36. Also, liquid passes through the passage 172 between the inner edge of the support plate to permit self-cleaning the space under the agitator 10.

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

The operator opens the lid 22 and then places the clothes or 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 202 in an electrical circuit 204 to either engage a warm water contact 206 in a circuit 208 to energize the warm water valve 210, or to engage a hot water contact 212 to energize the hot water valve 214 through parallel circuit 216, when the appropriate cam 218 on the timer is advanced to complete the circuit 204 from L-1 to L-2. For example, if the operator desires hot water, the contact 202 is placed in engagement with the hot water contact 212 and the circuit 216 is conditioned for operation.

Next the operator grasps the timer control knob 26 and turns the same to the desired washing period and closes the main line switch 220 which conditions the timer motor 29 for operation and lights the pilot light 222 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 8 through the inlet nozzle 112. As the water level in the tub rises above the opening 98 in the center post 94 the water flows therethrough into the float chamber 96 to raise the float 100 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 122 which in turn tilts the bracket 124 about its pivot 126 to tilt the pair of 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 224 and the appropriate cams to start the washing operation by oscillating the agitator 10 through the oscillating mechanism 70 and to advance the cams 28 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 204 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 filter or are carried by the washing liquid through the openings 60 in the bottom of the basket 44 where a relatively large portion tends to settle in the sediment collecting space 64 due to a less violent circulation of the liquid. After a predetermined period of agitation, the timer, advancing the cams 28 completes a circuit 226 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 circuits by means of the cams 28 of the timer which control the same.

As the tub is accelerated by the drive motor 76 a portion of the washing liquid within the tub and float chamber 96 is centrifugally discharged from the same up 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 valve 52 in the lower portion of the tub 8 is moved radially outwardly away from the circumferential discharge passage 51 against the stop 152 by means of centrifugal force and the increased hydrostatic pressure of the liquid acting thereon to permit a relatively large quantity of water at relatively high velocity to flow through the openings 60 in the bottom wall 58 of the basket through the sediment space 64 and out of the circumferential passage 51 into the stationary tub 6 to thereby remove the foreign particles therefrom. Also, due to the shape of the spacing lugs 50 the tendency of long pieces of fabrics to be snared thereby is minimized.

At full speed of rotation the valve is held open and a major portion of the washing water is removed from the fabrics in the tub. 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 208 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 the same is moved to deenergize the timer motor 29 and 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 inner tub 8 stationary. At the same time the natural resiliency of the centrifugally operated valve 52 causes it to move back to cover and seal the circumferential passage 51 at the lower portion of the tub against leakage. Simultaneously with this action the warm water valve is energized again by its cam through its circuit 208 and warm water is admitted to the tub 8 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 period.

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 64 and the circumferential opening 51 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 re-apply the brake to the receptacle to stop the same. During this washing cycle the fabrics have been washed with detergent, rinsed with 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 formed in 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 illustrative embodiments 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 thereof.

It is claimed:

1. In a washing machine, the combination of a rotatable tub having an imperforate sidewall and a bottom for receiving liquid and material to be washed, means for holding said sidewall in spaced relation to said bottom wall to define a

circumferential discharge passage disposed adjacent the bottom of said tub, means for effecting a washing operation in said tub and for rotating the same to remove the liquid therefrom, a sediment trap disposed adjacent the lower portion of said tub in communication with said passage and the interior of said tub, and an annular resilient sealing member for sealing said circumferential discharge passage when said tub is stationary and movable by centrifugal force when said tub is rotated above a predetermined speed to uncover said circumferential passage to discharge liquid in said tub through said sediment trap and passage to the exterior of said tub.

2. In a washing machine, the combination of a rotatable tub having an imperforate side wall and a bottom for receiving liquid and material to be washed, means for holding said sidewall in spaced relation to said bottom wall to define a circumferential opening about the outer periphery of the lower portion of said tub, a washing device in said tub, drive means for said washing device and for rotating said tub to remove the liquid therefrom, a sediment trap in the lower portion of said tub in communication with said opening, an annular resilient sealing member disposed about the outer periphery of said tub to seal said opening when the tub is stationary and movable by centrifugal force to uncover said opening when the tub is rotated to discharge a portion of the liquid in said tub through said trap and opening to the exterior of said tub, and means disposed outwardly of said annular resilient sealing member for limiting the opening movement of the same when said tub is rotated.

3. In a washing machine, the combination of a rotatable tub for receiving liquid and fabrics to be washed having a bottom and side wall with a liquid discharge space above the normal liquid level in said tub, a washing device in said tub, drive means for selectively operating said washing device and for rotating said tub, a sediment trap disposed about the outer periphery of said washing device, means for holding said side in spaced relation to said bottom wall to define a circumferential passage provided adjacent the lower portion of said side wall and in direct communication with said sediment trap, an annular resilient valve member disposed about the outer periphery of said side wall to cover and seal said passage when said tub is stationary and to uncover the passage when said tub is rotated, and an annular resilient holding member for said valve having one end formed integral with said valve and the other end secured to said tub.

4. A washing machine comprising a perforated open ended container for receiving materials to be washed, a rotatable receptacle having a bottom and sidewall mounted on a vertical axis disposed about the lower portion of said container to provide a space therebetween for free circulation of washing liquid, a washing device in said receptacle having a portion underlying the materials to be washed, drive means for selectively operating said washing device and for rotating said receptacle, a settling chamber for heavy foreign matter provided in said space at the lower portion of the container and receptacle, means for holding the bottom and sidewall of said receptacle in spaced relation to define a circumferential discharge passage about the outer periphery of the lower portion of said receptacle in direct communication with said space, and an annular resilient centrifugally operated sealing ring disposed about the periphery of said receptacle to

seal the passage when the receptacle is stationary and operable to open position when the same is rotated to permit the flow of liquid therethrough to flush the space between said container and receptacle.

5. In a washing machine, the combination of a substantially imperforate rotatable tub for receiving liquid having bottom and side walls, means for holding said side and bottom walls in spaced relation to define a circumferential passage therebetween, said side wall having an upper end defining a liquid discharge level, a perforate basket for receiving fabrics to be washed secured in said tub and having its side wall and bottom spaced from said tub to define a liquid conducting space, a washing device in said tub, means for selectively operating said washing device and for rotating said tub, an annular centrifugally operated resilient valve disposed about said tub to seal said circumferential passage when the tub is stationary and movable when said tub is rotated to uncover said passage to permit the flow of liquid therethrough from said space, and means disposed outwardly of said annular resilient valve for limiting the outward movement of the same when said tub is rotated.

6. A washing machine comprising a rotatable receptacle adapted to receive liquid therein having a bottom wall and a cylindrical side wall, means for holding said side in spaced relation to said bottom wall to define a circumferential passage adjacent the bottom of said side wall, annular resilient valve means disposed about the outer periphery of said receptacle to cover said passage when said receptacle is stationary and movable to uncover said passage when said receptacle is rotated above a predetermined speed, an annular member disposed about and spaced from said valve means to limit the outward movement of said valve means, and means for securing said member to said tub.

7. In a washing machine, the combination of a rotatable receptacle for holding washing liquid having a bottom wall and a side wall, means for holding said side in spaced relation to said bottom wall to define a circumferential passage through said side wall adjacent the lower end thereof, an annular centrifugally operated resilient toroidal valve member encompassing the lower end of said receptacle to seal the passage when said receptacle is rotating below a predetermined speed and operable to open said passage when said receptacle is rotated above a predetermined speed to permit the flow of washing liquid therethrough, an integral annular resilient depending flange on said valve for overlapping a portion of said tub, a stop member having a portion spaced from said valve to limit the radially outward movement of said valve, and means including a flange on said stop member overlapping said depending flange on said valve for securing the valve and stop to said tub.

8. A washing machine comprising a rotatable tub for receiving washing liquid and fabrics to be washed having a perforate bottom wall and an imperforate side wall extending above the normal liquid level in said tub, a base member adjacent the bottom wall of said tub, means for securing the bottom wall of said tub in spaced relation with respect to said base member to define a sediment trap adapted to collect heavy foreign particles which settle during the washing operation and to define a circumferential discharge passage therebetween, and an annular resilient valve member disposed about the

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outer periphery of said base member in contact therewith and a portion of said tub during the washing operation to prevent the flow of liquid through said circumferential discharge passage, and movable by centrifugal force to an open position when said tub is rotated above a predetermined speed to open the circumferential discharge passage to permit washing liquid to flow through said perforated bottom wall to flush said heavy foreign particles from said sediment trap.

9. A washing machine comprising a rotatable tub for receiving washing liquid and fabrics to be washed having a perforate bottom wall and an imperforate side wall extending above the normal liquid level in said tub, a base member adjacent the bottom wall of said tub, means for securing the bottom wall of said tub in spaced relation with said base member to define a sediment trap adapted to collect heavy foreign particles which settle during the washing operation and to define a circumferential discharge passage therebetween, an annular resilient valve member disposed about the outer periphery of said base member in contact therewith and a portion of said tub during the washing operation to prevent the flow of liquid through said circumferential discharge passage, and movable by centrifugal force to an open position when said tub is rotated above a predetermined speed to open the circumferential discharge passage to permit washing liquid to flow through said perforated bottom wall to flush said heavy foreign particles from said sediment trap, and a stop for limiting the outward movement of said resilient sealing element.

10. A washing machine comprising a rotatable tub for receiving washing liquid and fabrics to be washed having a perforate bottom wall and an imperforate side wall extending above the normal liquid level in said tub, a base member adjacent the bottom wall of said tub, means for securing the bottom wall of said tub in spaced relation with said base member to define a sediment trap adapted to collect heavy foreign particles which settle during the washing operation and to define a circumferential discharge passage therebetween, an annular resilient valve member disposed about the outer periphery of said base member in contact therewith and a portion of said tub during the washing operation to prevent the flow of liquid through said circumferential discharge passage, and movable by centrifugal force to an open position when said tub is rotated above a predetermined speed to open the circumferential discharge passage to permit washing liquid to flow through said perforated bottom wall to flush said heavy foreign particles from said sediment trap, a stop for limiting the radially outward movement of said resilient sealing element, and means for securing said resilient valve member and said stop to said base member.

11. A washing machine comprising a rotatable tub for receiving washing liquid and fabrics to be washed having a perforate bottom wall and an outwardly flaring imperforate side wall extending above the normal liquid level in said tub and over which a portion of the liquid is discharged when said tub is rotated, a washing device in said tub, a base member adjacent the bottom wall of said tub, means for securing and spacing the perforate bottom of said tub above said base member about the outer periphery of said washing device to define a sediment trap,

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said base member being thickened adjacent its outer periphery to provide a circumferential discharge passage between the same and said tub, an annular resilient sealing ring disposed about the outer periphery of said base member having a portion contacting the same and the lower portion of said tub to seal said passage during the washing operation, an integral flange depending from said sealing ring, a stop device having a portion disposed in spaced relation to the outer marginal edge of said ring for limiting the outward movement of the same when said tub is rotated, and means including a flange on said stop device for securing said sealing ring and said stop device to said base member.

12. A washing machine comprising a rotatable tub for receiving washing liquid including an imperforate base member and a side wall having its upper edge extending above the normal liquid level therein, said side wall having its major portion flaring upwardly toward said upper edge and a minor portion flaring downwardly toward said base, means for securing said side wall to said base to provide a unitary structure with a circumferential passage therebetween, a washing device in said tub, a perforate basket for receiving materials to be washed secured to 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 trap adapted to collect heavy foreign particles during a washing operation, an annular resilient ring disposed about the outer periphery of said tub for sealing said passage during a 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 said heavy foreign particles therefrom through said passage, means disposed outwardly of said resilient ring to limit the outward movement of the same when the tub is rotated.

13. A washing machine comprising a rotatable tub for receiving washing liquid including an imperforate base member and a side wall having its upper edge extending above the normal liquid level therein, and over which a portion of the 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, means for securing said side wall to said base to provide a unitary structure with a circumferential passage therebetween, a washing device in said tub, a perforate basket for receiving materials to be washed secured to 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 trap adapted to collect heavy foreign particles during a washing operation, an annular resilient ring disposed about the outer periphery of 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 foreign particles therefrom through said passage, a stop for limiting the radially outward movement of said ring, and means for securing said stop and said ring to said tub.

14. In a washing machine, the combination of a rotatable tub for receiving liquid and fabrics

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to be washed having a bottom and side wall with a liquid discharge space above the normal liquid level in said tub, a washing device in said tub, drive means for selectively operating said washing device and for rotating said tub, a sediment trap disposed about the outer periphery of said washing device, means for holding said side wall in spaced relation to said bottom wall to define a circumferential passage adjacent the lower portion of said side wall in direct communication with said sediment trap, an annular resilient valve member disposed about the outer periphery of said side wall to cover and seal said passage when said tub is stationary and to uncover said passage when said tub is rotated, and an annular guide secured to said tub disposed about and spaced from said annular valve to limit its outward movement when said tub is rotated and to guide the same toward said passage when said tub is stopped, said guide having one end spaced from said tub to permit the flow of liquid there-through when said tub is rotated.

15. In a washing machine, the combination of a rotatable tub having a bottom wall and a side wall for receiving liquid and material to be washed, means for effecting a washing operation in said tub and for rotating the same to remove liquid therefrom, a trap disposed adjacent the lower portion of said tub and in communication with the interior thereof adapted to collect foreign material from said tub, a plurality of circumferentially spaced members adjacent said side wall for holding said bottom and sidewalls

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in spaced relation to define a circumferential discharge passage for discharging liquid and said foreign material from said tub adjacent the bottom thereof, said circumferentially spaced members providing a plurality of circumferentially arranged passages disposed between and in communication with said circumferential discharge passage and said trap, said members being elongated circumferentially to facilitate removal of said foreign material, an annular resilient sealing member disposed about the outer periphery of said tub to normally seal said opening but movable by centrifugal force to uncover said circumferential discharge passage when the tub is rotated to discharge liquid and any accumulated foreign material from said trap to the exterior of said tub, and means disposed outwardly from said resilient sealing member for limiting the outward movement of the same when said tub is rotated.

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