May 5, 1953 T. R. SMITH 2,637,188

TUB ASSEMBLY FOR WASHING MACHINE

Filed Aug. 6, 1949 2 SHEETS—SHEET 1

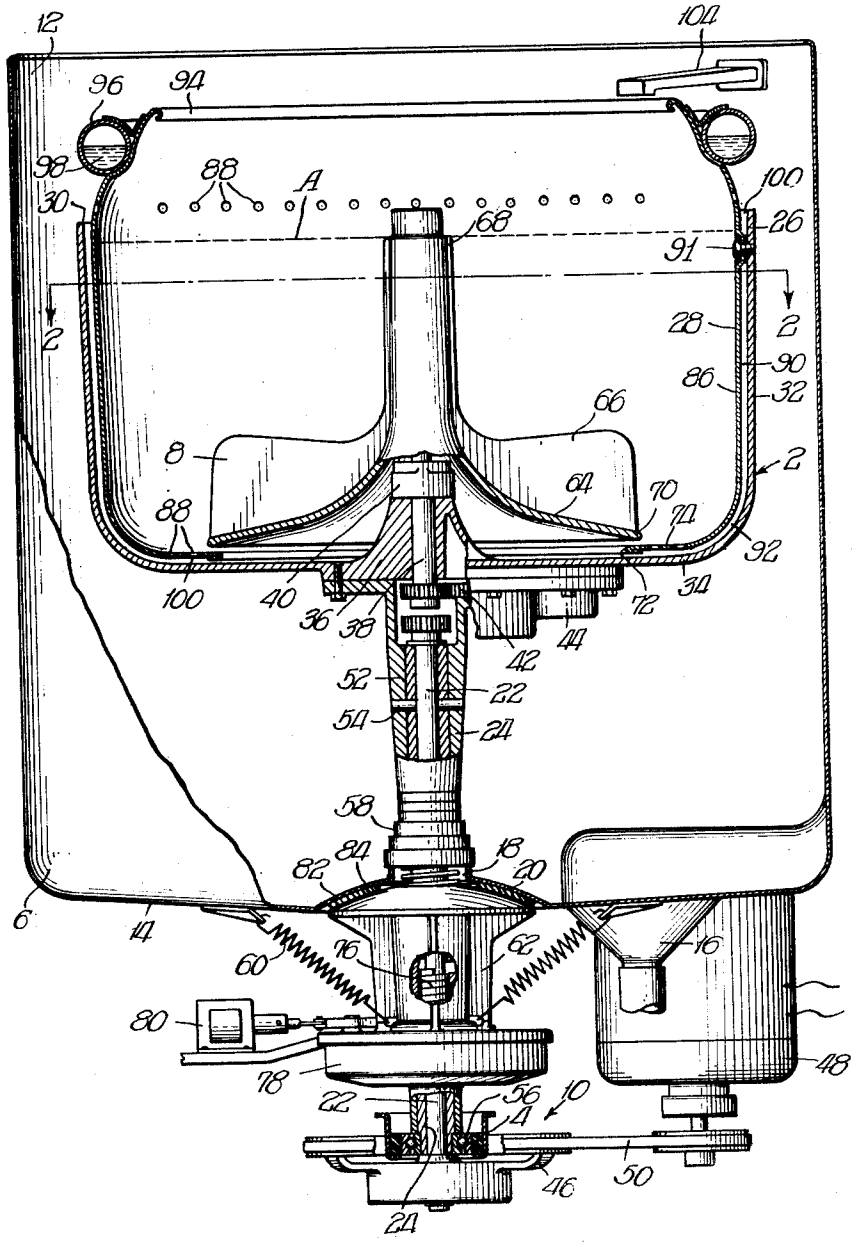


Fig. 1.

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TUB ASSEMBLY FOR WASHING MACHINE

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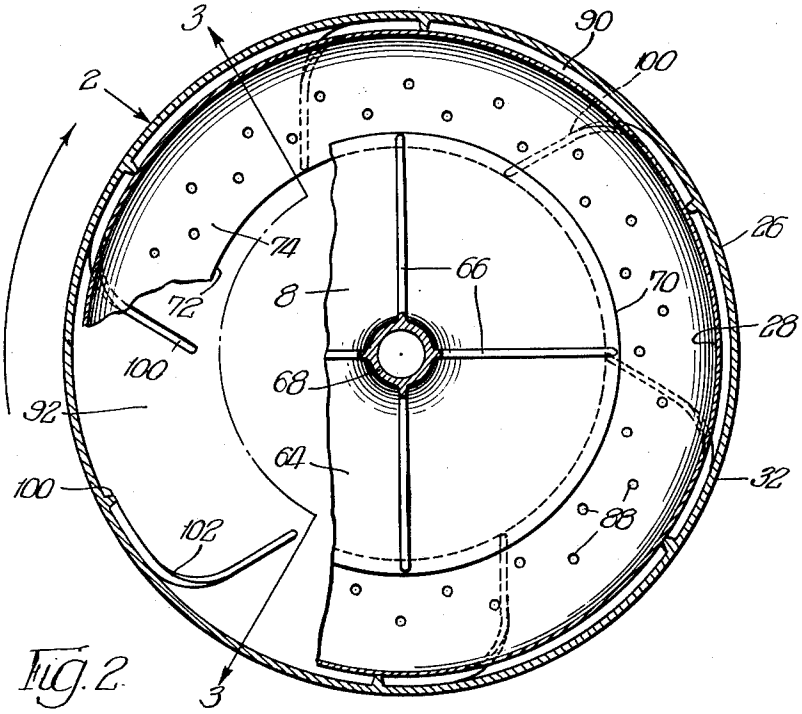


Fig. 2.

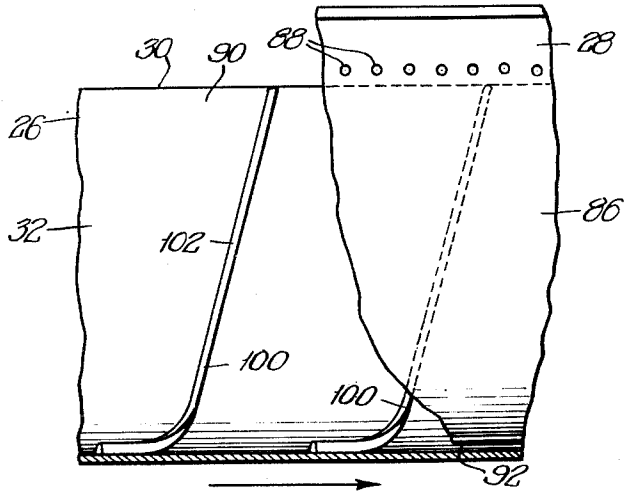


Fig. 3

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TUB ASSEMBLY FOR WASHING MACHINES

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Application August 6, 1949, Serial No. 108,993

7 Claims. (Cl. 68—23)

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This invention relates to washing machines and more particularly to washing machines having rotatable tubs of improved construction.

Among the objects of the invention is to provide a washing machine with an improved rotatable tub having means for facilitating the removal of heavy particles of dirt and foreign matter from the tub when the same is accelerated.

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 zone 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 zone. 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 with a rotatable tub of double wall construction provided with means therebetween for ejecting heavy particles of dirt from a sediment space located in the lower portion thereof.

It is another object of the invention to provide a washing machine with a rotatable tub of double wall construction which is provided with elevating means to facilitate the removal and conveyance of heavy particles from the lower portion thereof to the outside of the tub through the space between the walls of the tub when the same is rotated.

It is yet another object of the invention to provide a washing machine having a rotatable tub of double wall construction formed to provide a sediment space in the lower portion thereof and having a plurality of vanes between the walls which extend into said sediment space for ejecting liquid and heavy particles of dirt from the sediment space over the top edge of the tub without contacting the fabrics being washed.

Still another object of the invention is 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 of a washing machine provided with a rotatable tub of double wall construction embodying the improved elevating means of the present invention;

Figure 2 is a broken horizontal cross-sectional view of the rotatable tub taken in a plane represented by line 2—2 of Figure 1 of the drawings and showing the annular liquid conducting space and elevating means the arcuate arrow representing the direction of rotation of the tub; and

Figure 3 is a partial sectional view taken in the planes represented by line 3—3 of Figure 2 of the drawings and disclosing the elevating means in detail. The arrow indicates the direction of rotation of the tub.

Referring now more in detail to one form of a combined washing and drying machine, embodying a rotatable tub of double wall construction 2 mounted for rotation about a vertical axis and made in accordance with the present invention, there is shown a base structure 4 which provides a support for an outer stationary tub 6, a support for the inner rotatable tub structure 2, having a centrally located vertically mounted agitator or washing device 8 disposed therein, as well as a support for mechanism generally referred to as 10, for operating the agitator and for rotating the tube 2 in a washing cycle, as will be hereinafter more fully described.

The outer stationary tub 6 may be supported from the base 4, in any suitable manner, and is preferably formed circular in horizontal cross-section, with an upper open end 12 disposed above the top of the rotatable tub 2 to intercept and deflect downward any liquid discharged from the tub when it is rotated. The stationary tub 6 further includes a lower bottom wall 14 having a drain opening 16 and a centrally disposed enlarged opening 18 in a crowned portion 20 through which vertical coaxial shaft means extend. The shaft means is in the form of an inner rotatable shaft 22 and an outer rotatable tubular shaft 24, for supporting and rotating the inner tub 2 and for actuating the agitator 8.

Disposed within and at the upper portion of the outer stationary tub 6 and secured to the upper end of the outer tubular shaft 24 is the inner rotatable tub 2, also preferably circular in horizontal cross-section, which comprises two separate sections to provide an outer tub or re-

ceptacle 26 and an inner tub or container 28. The outer tub or receptacle 26 is imperforate and substantially cup-shaped in vertical cross-section with its open end facing upwardly and terminating to define a top edge 30 above the normal liquid desired in the tub and over which the liquid is discharged when the tub is rotated. This receptacle comprises an upwardly and outwardly directed frusto-conical side wall 32 which merges at its lower end with a generally horizontal bottom wall 34 having a centrally located raised hub portion 36 thereon. Projecting through and upwardly from the hub 36 is a vertically disposed oscillatable shaft 38 splined or connected in any suitable manner to the agitator 8 for actuating or oscillating the same about its vertical axis to agitate the water and fabrics to be washed within the tub. Any suitable sealing means 40 may be utilized between the hub 36 and the shaft 38 to provide a fluid-tight joint.

Means for oscillating the agitator are provided by suitable oscillating mechanism generally indicated at 42 which, in this construction, is carried in a gear housing 44 disposed at the bottom of and bolted to the outer tub 26 to increase the mass thereof. This oscillating mechanism is preferably directly operated by the inner vertically disposed rotatable shaft 22 which has a driven pulley 46 secured thereto at its lower end, the same being continuously rotated in one direction by a motor 48 when energized, by means of a belt 50.

The gear housing 44 is further provided with a downwardly projecting hub 52 concentric with the shaft means and rigidly secured to the upper end of the outer tubular shaft by means of pins 54, while the lower end of the shaft means 22 and 24 is mounted in a combination radial and thrust bearing 56 adjacent the lowermost portion of the base 4. Leakage between the outer hollow shaft 24 and stationary tub 6 is prevented where the shaft means traverses the tub at the crowned opening 20, by means of a resilient spring biased seal or boot 58 having upper and lower sealing surfaces adapted to engage the lower portion of the hub 52 and an upstanding portion on the stationary tub about the opening 18, respectively.

The combined radial and thrust bearing 56 provides the sole support for the rotatable tub which is free to tilt thereabout at which time the tub is capable of moving laterally. 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 60 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 of the stationary tub 6 and the opposite ends are connected to a damper housing 62 disposed adjacent to and beneath the bottom of the stationary tub. This damper housing is also disposed concentric with and journalled on the outer shaft 24 and moves laterally therewith.

The agitator 8, disposed within the rotatable tub 2, is formed with a flaring base or body portion 64 extending downwardly and outwardly about the hub 36 to underlie the clothes, and has one or more blades 66 extending radially upwardly and outwardly from the upper portion of the base 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 center-post 68 disposed on the vertical axis of the tub and extends upwardly above the normal liquid level within the tub. Also, the outer periphery 70 of the base 64 preferably extends outwardly and covers the inner end 72 of the bottom wall 74 of the inner tub 28 to prevent fabrics from entering thereunder.

As previously mentioned, the material introduced into the rotatable receptacle 2 is subjected to a washing action through the oscillating action of the agitator 8 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 tub, suitable clutch mechanism 76 carried in the damper housing 62 may be provided for affecting a driving relation between the inner shaft 22 and the outer shaft 24. Means are provided in the form of a brake mechanism 78 secured in part to the stationary tub 6 and to the outer shaft 24 for holding the tub stationary during the washing operation and permitting the rotation of the tub during the spinning operation. The operation of both the brake 78 and the clutch 76 is under control of an electrically operated solenoid 80 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 22 and 24 together to drive the same in unison.

The damper housing 62 which provides a support at least in part for the clutch and brake mechanism and has the centering springs connected thereto, is also provided at its uppermost end with a spherical surface 82 having dampening material 84 attached thereto which is positioned to engage the crowned portion 20 of the stationary tub 6. This damper is provided to reduce the amplitude of lateral movement of the receptacle during the spinning operation.

A clutch, centering means, brake and damper mechanisms suitable for affecting the above operation are described and claimed in my copending 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 a washing machine as herein disclosed and that other suitable types may be utilized.

Referring now more particularly to the details of construction of the tub assembly 2 which is rotatable about its vertical axis there is shown the substantially imperforate outer tub or receptacle 26 which includes the generally horizontal bottom wall 34 and the slightly upwardly and outwardly flaring cylindrical side wall 32 having the top edge 30 disposed above the normal liquid level desired therein. It is to be noted that the lower portion of the side wall 32 and outer portion of the bottom wall are curved gradually to provide a smooth surface in order to prevent heavy foreign particles from being held in the corner.

The inner tub 28 is in the form of an open-ended basket or container having its side wall 86 adjacent the top edge 30 of the receptacle and the bottom wall 74 provided with perforations 88. The inner tub is disposed in substantially parallel spaced relation with the side wall 26 and the bottom wall 34 of the imperforate receptacle to pro-

vide an upper annular space 90 between the side walls 32 and 86 and a lower radially extending space 92 between the bottom walls 34 and 74 to permit free flow of the washing liquid out of the receptacle and over the top edge 30 upon rotation thereof without contacting the fabrics. In addition, the openings 88 in the bottom of the basket permit heavy particles of dirt and foreign matter to flow therethrough and settle in the lower space 90 during the washing operation. Therefore, the space 92 defines a sediment zone or space which functions in a manner to be hereinafter described.

The basket 28 may be secured to the receptacle 26 to form a unitary structure in any suitable manner, such as, for example, by screws or bolts 91, and has its lower innermost portion disposed in spaced relation to the bottom edge of the agitator and to the bottom 34 of the receptacle to permit free flow of washing liquid under the agitator around the edge 72 and into the sediment zone 92. 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 94 whereby the operator may have access to the interior of the basket.

In this particular construction, a hollow toroidal balancing member or ring 96 is mounted upon the upper portion of the basket and preferably contains a mobile material 98, of any suitable type, having a relatively high specific gravity which serves as a balancing means for tending to maintain the rotatable tub 2 in its vertical position when it is rotated at relatively high speed, above its critical speed, under unbalanced load conditions.

Disposed within the space between the receptacle and basket there is provided a plurality of inclined elevating ribs or impelling vanes 100 which preferably extend from the upper edge 30 of the tub downward within the space 90 and into the sediment space 92 and terminate adjacent the inner edge 72 of the basket. The inclination of these vanes is such that the lower ends thereof are spaced forwardly of the upper ends in the direction of rotation of the tub, or to state it otherwise, the vanes are inclined upwardly in a direction opposite to the direction of rotation of the tub. These vanes are preferably substantially equal to the thickness of the space 90 and are shown herein as being formed integral with the receptacle. It is to be understood, however, that these ribs may be formed integral with the basket structure or, if desired, the same may be formed as separate members and secured to either the receptacle or the basket.

When the tub is stationary during the washing operation the liquid within the basket is agitated rather violently by the agitator 8 and due to this action a small portion of the liquid is caused to circulate between the interior of the basket and the space between the basket and the receptacle through the openings 88 in the bottom wall 74 and carries with it heavy dirt and other foreign particles removed from the soiled fabrics which tend to settle therein 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 interior of the basket and the major portion of these particles for the most part will remain in the sediment zone.

After the washing operation the tub is rotated to centrifugally extract the liquid therefrom. As the tub is accelerated and there is relative motion between the tub and the liquid the inclined vanes 100 act in effect as a centrifugal pump to elevate the liquid upwardly from the sediment zone 92 through the annular space 90 and over the top edge 30 of the tub. It is obvious that the greater the accelerating force the more liquid the vanes will force through the annular space 90 and in so doing a relatively large quantity of liquid flows through the perforations 88 in the bottom of the basket and through the passageway beneath the agitator and around the edge 72 into the sediment zone 92, and in so doing it will pick up the heavy dirt and carry the same upward therewith and out of the tub and deposit the same in the stationary tub 6 wherein it is conducted to the drain 16.

It has been found that by inclining the ribs in the manner hereinbefore indicated at an angle on the order of from 10 to 30 degrees that the major portion of the heavy dirt is caused to climb up the inclined leading edge 102 on the vanes 100 and be thrown out of the tub on the initial acceleration. Also, these vanes are effective to remove heavy dirt when liquid is sprayed into the tub during the spinning operation. In addition, the vanes act to restrict the movement of the liquid in a horizontal plane during acceleration of the tub. The number of vanes or ribs used depends upon various conditions and satisfactory results have been obtained with two ribs. When the tub has attained full speed the effect of the ribs is negligible in that the centrifugal force and the outwardly flaring shape of the annular space 90 will conduct the liquid out of the receptacle without them.

The operation of a washing machine hereinabove described and incorporating a tub of double wall construction with elevating vanes therein made in accordance with the invention is as follows:

The operator places the clothes or fabrics to be washed through the opening 94 into the interior of the basket 28 including with it the proper quantity of detergent. Thereupon the operator may manipulate a dial to select the proper water temperature and to adjust other control mechanism (not shown) to determine the washing cycle which conducts water into the rotatable tub through a nozzle 104 disposed at the upper portion thereof.

When the liquid in the tub reaches a predetermined level a control mechanism (not shown) interrupts the flow of water and the drive motor 48 is energized to start the washing operation by oscillating the agitator 8 through the oscillating mechanism 42.

During the washing operation heavy particles of foreign matter and dirt removed from the fabrics gravitate toward the bottom of the tub and are carried by the washing liquid through the openings 88 in the bottom 74 of the basket 28 where a relatively large portion tends to collect in the sediment zone 92 due to the less violent circulation of water therein. After a predetermined period of agitation, the brake solenoid 80 is energized to release the brake 78 holding the rotatable tub 2 to permit rotary movement thereof and at the same time to cause the clutch 76 to be engaged to directly connect the continuously rotated drive shaft 22 to the hollow rotatable shaft 24 carrying the tub to rotate the same, at which time no relative movement takes place between the agitator and the tub.

As the tub is accelerated by the drive motor 48 the liquid initially tends to remain stationary and the vanes 100 act to scoop or pump the water in

the sediment zone 92 and annular space 90 upwardly and discharge the same over the top edge 30 of the receptacle 26. In so doing additional water flows from the interior of the tub through the perforations 86 in the bottom of the basket and around the edge 72 on the bottom wall into the sediment zone to create a relatively high velocity therethrough to thereby remove the foreign particles therefrom. Also, the liquid is discharged through the horizontal perforations in the side wall of the basket adjacent the top edge of the receptacle.

When the liquid level passes the outermost perforations in the bottom wall, flow through the annular space 90 is terminated and the remaining liquid is conducted through the perforations provided in the upper portion of the side wall 86 of the basket. At full speed of rotation the major portion of liquid is removed from the fabrics and during this time a flush rinse of water is admitted to the tub through the inlet nozzle 104 to remove a portion of the remaining soapy water and at which time the relative movement between the water and the tub permits the vanes to remove the water and the remaining heavy dirt entrained therewith very rapidly. At the end of the spinning operation the brake solenoid 80 is deenergized and in so doing applies the brake 78 and releases the clutch 76 to stop and hold the tub stationary. Warm water for rinsing is thereupon admitted to the tub through the nozzle and upon attaining the proper level the flow of water is terminated and the drive motor 48 is energized to initiate the agitate rinse period.

The operation of the washing machine during the rinse period is identical to the operation thereof during the washing period, except it is of shorter duration, after which the tub is again rotated and the vanes 100 act to expel a relatively large quantity of water initially from the tub and to discharge the same over the top edge thereof. At the end of the final spin period, 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 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 remove the fabrics from the tub.

The details of construction and the operation of an entire control assembly including an unbalance safety switch suitable for controlling a washing machine 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.

From the foregoing it can be seen that a rotatable tub of double wall construction for washing machines has been provided with an annular space therebetween and a self-cleaning sediment zone adjacent its lower portion having vanes disposed in the space and zone so that, when the tub is accelerated, the vanes act to remove a relatively large quantity of water therefrom and at the same time carry with it heavy dirt and foreign particles from the sediment zone.

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 thereof.

It is claimed:

1. In a washing machine having a tub adapted to receive liquid and material to be washed and to be spun to centrifugally extract the liquid from the material, said tub comprising an imperforate outer tub having a bottom wall and an upwardly flaring side wall with an upper open end extending above the normal liquid level therein, and an open ended inner tub disposed in said outer tub to provide a space therebetween along the side and bottom walls of said outer tub, means for securing said inner and outer tubs to provide a unitary structure, means for providing communication between the interior of said inner tub and the space at the lower portion thereof, and mechanical liquid elevating means disposed in said space, whereby when said tub is accelerated said elevating means act to remove the liquid therein out of contact with the fabrics in said inner tub.

2. In a washing machine having a tub adapted to receive liquid and material to be washed and to be spun to centrifugally extract the liquid from the material and being provided with an agitator having a part underlying the fabrics to be washed, said tub comprising an imperforate receptacle having a bottom wall and an upwardly and outwardly flaring side wall with an upper open end, and an open ended basket secured in said receptacle in spaced relation thereto to provide an annular space between said side walls and a sediment space at the bottom of said receptacle, said basket having its lower inner end terminating adjacent the outer periphery of said agitator, means for conducting liquid from the interior of said basket into said space, and inclined mechanical liquid elevating means disposed in said spaces for ejecting liquid therefrom when said tub is accelerated.

3. In a washing machine having a tub adapted to receive liquid and material to be washed and to be spun to centrifugally extract the liquid from the material, said tub comprising an imperforate receptacle having a bottom and an upwardly and outwardly flaring side wall terminating in an upper edge above the normal liquid level desired in said tub, a container secured in said receptacle in spaced relation thereto to provide an annular liquid conducting space therebetween and from the bottom of said receptacle to define a sediment zone, said container being provided with openings to permit the flow of liquid into the receptacle, and a plurality of vanes disposed in said space and sediment zone inclined upwardly in a direction opposite to the direction of rotation of said tub for ejecting the liquid and sediment therein when said tub is accelerated.

4. A tub for a washing machine adapted to be rotated about a vertical axis, comprising an imperforate receptacle having side and bottom walls, an open-ended container having an imperforate side wall and an inwardly extending bottom wall having discharge openings therein, the bottom and side walls of said container and receptacle being spaced apart to define an annular liquid conducting space between said side walls and a sediment space between said bottom walls, a plurality of vanes extending from said sediment space into said annular liquid conducting space for ejecting liquid from said spaces to flush said sediment space when said tub is accelerated, and means for securing said container and receptacle in spaced relation to provide a unitary structure.

5. In a washing machine having a tub adapted to receive liquid and material to be washed and to be spun to centrifugally extract the liquid from the material, and being provided with an agitator having a part underlying the fabrics to be washed, the combination of a tub adapted to be rotated about a vertical axis, comprising an imperforate receptacle having side and bottom walls, an open-ended container having an imperforate side wall and an inwardly extending bottom wall having discharge openings therein, the bottom and side walls of said container and receptacle being spaced apart to define an annular liquid conducting space between said side walls and a sediment space between said bottom walls communicating with the interior of said container through said discharge openings, said container having its lower inner end terminating adjacent the outer periphery of said agitator to provide a liquid passage from the interior of said container into said sediment space, a plurality of vanes extending from said sediment space into said annular liquid conducting space in an inclined direction opposite to the direction of rotation of said tub for ejecting liquid from said spaces to flush said sediment space when said tub is accelerated, and means for securing said container and receptacle in spaced relation to provide a unitary structure.

6. A rotatable tub for receiving washing liquid and fabrics to be washed and mounted for rotation about a vertical axis, comprising an open-ended container having a bottom wall and a side wall with liquid conducting openings therein, an imperforate receptacle having an upwardly flaring frusto-conical side wall and a substantially horizontal bottom wall spaced from the lower portion of said container to define an annular liquid conducting space between said side walls and a sediment space between said bottom walls, said sediment space being in communication with the interior of said container, mechanical liquid elevating means disposed in said annular space and sediment space inclined upwardly in a direction opposite to the direction of rotation of said tub to eject the liquid and sediment therein when said tub is accelerated, and means for securing said container and receptacle together to form a unitary structure.

7. A rotatable tub for receiving liquid and fabrics to be washed and mounted for rotation about a vertical axis, comprising an open-ended container provided with a side wall and a bottom wall extending radially inward and having openings therein, an imperforate receptacle having an upwardly flaring frusto-conical side wall extending above the normal desired liquid level therein and a substantially horizontal bottom wall secured in substantially parallel spaced relation to said container to define an annular liquid conducting space between said side walls and a sediment space between said bottom walls, and a plurality of mechanical liquid elevating means disposed across said spaces to restrict the free flow of liquid in a horizontal plane, whereby when said tub is accelerated said elevating means ejects the liquid from said spaces to flush said sediment space.

THOMAS R. SMITH.

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