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ROTATABLE TUB ASSEMBLY FOR WASHING MACHINES

Filed June 26, 1952

2 Sheets-Sheet 1

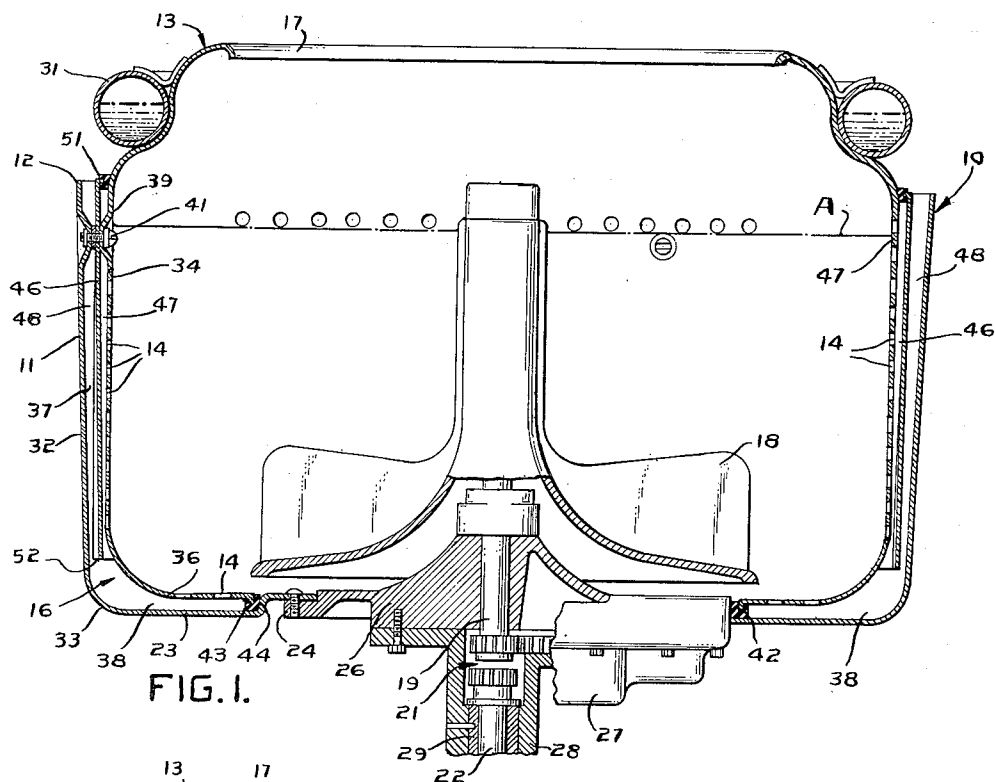


FIG. 1.

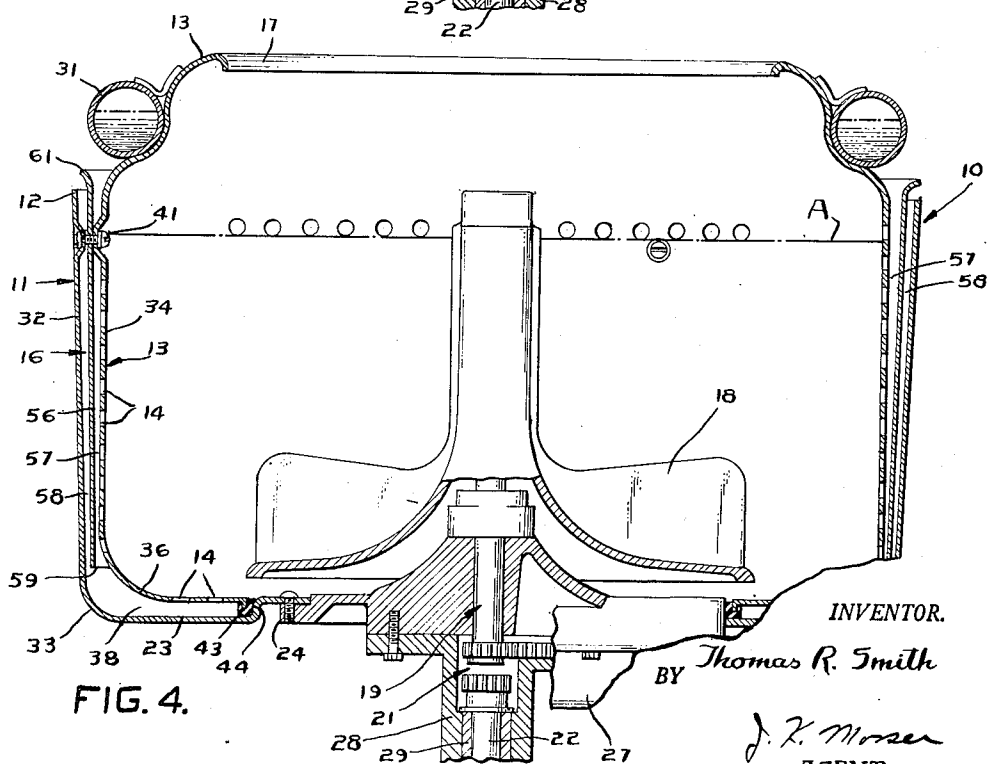


FIG. 4.

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FIG. 2.

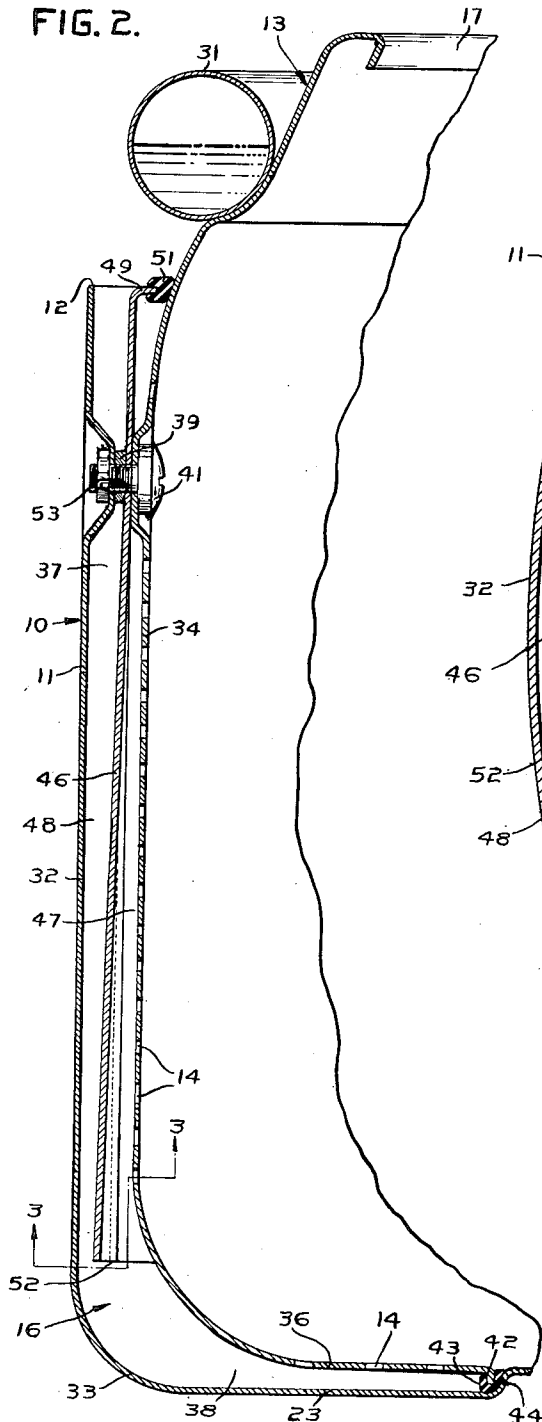
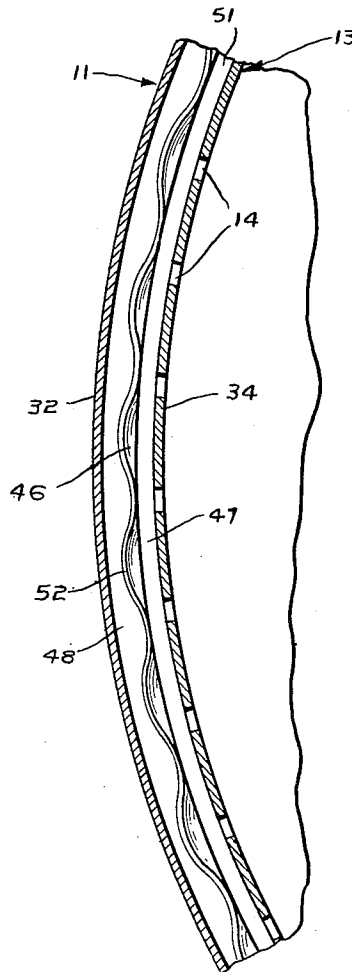


FIG. 3.



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ROTATABLE TUB ASSEMBLY FOR WASHING MACHINES

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11 Claims. (Cl. 210-76)

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This invention relates to washing machines for fabrics and more particularly to washing machines having a double tub construction which is rotated about its vertical axis.

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

In washing machines having rotatable tubs wherein a washing operation and a centrifugal drying operation take place there are times, when washing some fabrics, that heavy particles of dirt, sand and other sedimentary material 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 in some of the fabrics which, of course, causes the same to be spotted or soiled. Even in installations where 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.

This invention is primarily directed to washing machines embodying a rotatable double tub construction; the inner tub being perforate and spaced from the outer imperforate tub to provide an annular liquid conducting space therebetween with a generally horizontal and a generally vertical section. The horizontal section is adapted to collect heavy lint and sedimentary material and the vertical section is divided by means of a generally cylindrical member or skirt to provide separate inner and outer annular channels. In the preferred form, the liquid passing through the perforations in the side wall of the inner tub into the inner channel is conducted by the cylindrical skirt downwardly and it passes around the lower edge of the skirt and moves upwardly through the outer channel to be discharged over the upper open end of the outer imperforate tub. Also, the sedimentary material in the horizontal section of the space is moved outwardly by centrifugal force and the velocity of the washing liquid to adjacent the lower edge of the skirt whereat it is entrained by the liquid and passes upward through the outer annular channel along with the washing

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liquid. In another form, an annular skirt divides the generally vertically extending annular space between the inner and outer tubs to provide inner and outer channels which both direct the liquid upwardly and over the upper open end of the outer tub, the inner channel directing the liquid flowing through the perforations in the side wall of the inner tub upwardly and the outer channel conducting the liquid and sedimentary material from the lower section of the tub.

Accordingly, it is an object of the invention to provide a washing machine with a rotatable double tub construction having an annular liquid conducting means therebetween which is divided to provide inner and outer channels, with the outer channel being utilized to conduct sedimentary material from the lower portion of the tub.

It is another object of the invention to provide a washing machine having a rotatable double tub construction with an annular skirt between the two which prevents the liquid flowing through the side wall of the inner tub from interfering with the liquid flowing upwardly through the space on the opposite side of the skirt.

It is still another object of the invention to provide a washing machine having a rotatable double tub construction including a perforate inner tub and an imperforate outer tub with an annular skirt disposed therebetween which directs the liquid passing through the inner tub downwardly and then upwardly on the opposite side of the skirt to entrain sedimentary material collected at the bottom of the tub.

It is still another object of the invention to provide a washing machine having a rotatable tub construction including an inner perforate basket and a spaced outer imperforate receptacle with an annular liquid conducting space therebetween divided by an annular skirt into inner and outer channels, the inner channel directing the liquid discharged through the perforations in the side wall of the basket and the outer channel directing the liquid delivered adjacent the bottom of the tub over the upper end of the container.

Other objects, features, capabilities, and advantages are comprehended by the invention as will later appear and as are inherently possessed thereby.

Referring to the drawings:

Figure 1 is a partial vertical sectional view of a rotatable double tub construction for a wash-

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ing machine with the improved liquid conducting means incorporated therein;

Figure 2 is an enlarged partial vertical sectional view of the improved double tub construction shown in Figure 1;

Figure 3 is a horizontal sectional view of the liquid conducting channel taken on the line 3-3 of Figure 2; and

Figure 4 is a partial vertical sectional view of a rotatable tub construction showing a modified construction for the improved liquid conducting means.

Referring now more in detail to the drawings for a combined washing and centrifugal drying machine, embodying a generally cylindrical rotatable tub of double wall construction and made in accordance with the present invention, there is shown in Figures 1 to 3 a tub assembly 10 which is adapted to be rotated about its vertical axis. This tub assembly generally comprises a cup-shaped outer imperforate tub or receptacle 11 having an upper open end defining a top edge 12 disposed above the normal liquid level A desired therein for the washing operation, and a spaced inner perforate tub or container 13, having perforations or openings 14, secured therein in spaced relation to provide an annular liquid conducting space 16 therebetween. The upper end of the container 13 has an opening 17 through which the washing liquid and fabrics to be washed are inserted or removed.

Washing means, such as, for example, a centrally located vertically mounted oscillatable agitator 18 is disposed within the confines of the container 13 to affect the proper washing action and this agitator may be oscillated by means of a shaft 19 whose lower end is connected to oscillating mechanism, generally referred to at 21, which in turn is driven by an inner vertical shaft means 22 in any suitable manner by means of a drive motor (not shown). The imperforate outer tub or receptacle 11 has a lower horizontal wall 23 whose inner end overlaps and is secured to the outer peripheral portion 24 of a central hub 26 which journals the oscillatable shaft 19 and houses a portion of the oscillating mechanism. The hub 26 in turn is bolted to a gear housing 27 having a lower central tubular portion 28 rigidly secured to an outer vertical tubular shaft means 29 for supporting and rotating the entire tub assembly. The inner shaft 22 for operating the oscillating mechanism 21 and the surrounding tubular shaft 29 extend downwardly and are supported by a combined radial and thrust bearing (not shown), and when the tub is rotated during the liquid extracting operation the inner and outer shafts 22 and 29 are clutched or locked together in any suitable manner to rotate in unison.

While the particular mounting for the rotatable tub construction 10 is immaterial, in this instance, the tub is mounted for lateral movement and a balancing ring 31 secured adjacent the upper open end 17 of the perforate container 13 is utilized to aid in balancing improperly distributed fabric loads during the extracting operation. Suitable additional mechanism may be provided to either hold the tub 10 stationary and vertical during the washing operation or to aid in smoother operation when the tub is rotated during the extracting operation.

It has been found that during the washing operation sedimentary material removed from the fabrics passes through the openings 14 in the container 13 and has a tendency to collect in the

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annular space 16 between the perforate container and the receptacle 11 and under certain conditions it is rather difficult to remove this material should it be given time to settle therein.

Referring now more particularly to the details of construction of the tub assembly 10, the substantially imperforate outer tub or receptacle 11 includes the generally horizontal bottom wall 23 and a generally vertical upwardly and outwardly flaring cylindrical side wall 32 with its open top edge 12 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 23 provides a relatively large and smooth curved surface 33 in order to reduce the tendency for heavy foreign particles or sedimentary material to cling or stick at this point.

The perforate inner tub or container 13 is open-ended and has its perforate cylindrical side wall 34 and flat perforate bottom wall 36 disposed in substantially parallel spaced relation with respect to the side and bottom walls 32 and 23, respectively, of the imperforate receptacle 11 to provide the relatively narrow annular liquid conducting space 16. This space includes an upper or vertical liquid conducting space or section 37 between the side walls 32 and 34 and a lower radially extending or horizontal annular liquid conducting space or section 38 between the bottom walls 23 and 36, and permits relatively free circulation of the washing liquid therethrough during the washing operation and free flow of the washing liquid out of the receptacle 11 over the top edge 12 upon rotation of the tub without contacting the fabrics within the container 13. In addition, the openings 14 in the bottom and side wall of the container readily permit heavy particles of dirt and other sedimentary material to flow therethrough into the annular space and settle toward the lower horizontal section 38 during the washing operation. Therefore, in effect, this space defines a sediment collecting zone or space which functions in a manner to be hereinafter described.

The inner tub or container 13 is rigidly secured in spaced relation to the receptacle adjacent the upper edge 12 to form a unitary structure in any suitable manner, such as, for example, by a series of spacers or grommets 39 and screws or bolts 41, and the lower portion of the container is centered and held against radial displacement by providing a downwardly directed channel section 42 at the inner edge of the bottom wall 36 with an annular U-shaped gasket 43, which in turn engages a vertical cylindrical shoulder 44 provided on the bottom wall 23 of the imperforate receptacle 11 adjacent the outer periphery of the agitator 18. The upper portion of the container is preferably imperforate and extends upwardly and inwardly above the normal liquid level to retain the fabrics being washed and it terminates to define the opening 17, whereby the operator may have access to the interior of the container.

The vertically extending annular space 37 between the side walls 32 and 34 of the inner and outer tubs, respectively, is divided by means of an open-ended generally cylindrical member or skirt 46 into inner and outer annular channels 47 and 48, respectively. When positioned in the vertical space 37, the upper end of the skirt 46 has an intumed portion 49 carrying an annular gasket 51 which contacts the outer periphery of the vertical wall 34 of the container above the normal liquid level in the tub to seal the upper end

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of the inner channel 47 against the flow of liquid in the upward direction. From the upper end of the skirt, the skirt flares downwardly and outwardly and its lower bottom edge 52 terminates adjacent the bottom of the receptacle at the curved portion 33. Since the diameter of the skirt 46 is larger at the lower end than at the upper end and the inner channel is unobstructed, the flow of liquid passing through the perforate container 13 will all be in the downward direction. In addition, the lower portion of the skirt is fluted or corrugated, as clearly shown in Figure 3, to generally equalize the cross-sectional areas between the inner and outer channels 48 and 47 to provide as large an area as possible when the liquid is being discharged through the outer channel 48. This fluted construction tends to maintain a generally constant cross-sectional area upward through the outer channel. The skirt 46 is further provided with spaced openings 53 mating with the aligned openings provided in the receptacle and container and it is rigidly secured in position along with the container 13 by means of the grommets 39 and bolts 41 to provide a unitary structure.

From the foregoing it can be seen that when the tub is stationary during the washing operation, the liquid and fabrics within the perforate container 13 are agitated rather violently by the vanes on the agitator 18 and due to this action a portion of the liquid is caused to continuously circulate through the openings 14 in the container into and out of the annular spaces 47 and 38 provided between the container and imperforate receptacle 11. In so doing a relatively large proportion of the heavy particles and other sedimentary material will tend to pass through the openings into the annular space, and since the openings 14 tend to break up the violent water action in this space the sedimentary material will tend to settle in the annular space 38 adjacent the outer curved corner 33.

After the washing operation, the tub is rotated about its vertical axis through the shaft means 22 and 29 to centrifugally extract the liquid therefrom. As the tub is accelerated, washing liquid tends to move outwardly by centrifugal action and due to the upwardly flaring side wall 32 of the receptacle 11, the liquid moves past the fluted lower end 52 of the skirt 46 and upwardly through the outer channel 48 to be discharged over the top edge 12 of the receptacle. At the same time, liquid flows through the openings 14 in the side and bottom walls 34 and 36, respectively, of the container. The liquid entering the space 33 through the openings 14 in the bottom wall 36 moves rapidly radially outwardly and entrains a portion of the sedimentary material, and the liquid entering the inner annular channel 47 through the perforate side wall 34 in the container is directed downwardly out of contact with the fabrics toward the bottom by the downwardly and outwardly flaring imperforate skirt 46. Since the upper end of the skirt 46 is sealed, all of the liquid entering the inner channel must of necessity first move to the bottom of the tub, pass around the lower edge 52 of the skirt 46 and then upwardly through the outer channel 48. The downwardly moving liquid is discharged in the direction of the bottom wall, which in turn results in a certain amount of turbulence upon reversal of the direction of flow in moving to the inlet of the outer channel 48. This rapid water action, along with the radially moving liquid, entrains heavy dirt and other sedimentary

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material and carries the same upwardly and discharges it over the top edge 12 of the imperforate receptacle.

At the end of the rotating or extraction operation, the tub is stopped and held stationary by any suitable means. It should be mentioned that 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 to extract the rinse water and remove the remaining sedimentary material at the bottom of the tub.

Referring now to Figure 4, there is shown a modified annular member or skirt construction incorporated with the above described rotatable double tub construction 10. Since like parts are given like reference characters, a further detailed description is not deemed necessary. In this instance, the perforate inner container 13 and the imperforate receptacle 11 is provided with the usual annular liquid conducting space 16 between the side walls 32 and 34 and bottom walls 23 and 36, respectively, and an annular member or skirt 56 is disposed in the generally vertical section of the annular space 16 between the side walls 32 and 34 to provide inner and outer liquid conducting channels 57 and 58, respectively. This skirt may be securely anchored in the space by the container securing means 41 and is preferably disposed substantially parallel to the upwardly flaring imperforate side wall 32 of the receptacle. As in the first modification, the lower open end 59 of the skirt 56 terminates adjacent the bottom of the tub; however, the upper end 61 is open and extends slightly above the top edge 12 of the receptacle. In this arrangement, both the inner and outer channels 57 and 58 are open at their lower and upper ends, to provide separate and independent parallel liquid conducting paths.

In operation, after the washing operation and with the tub being rotated, the liquid flowing through the openings 14 in the side wall 34 of the container 13 passes into the inner channel 57 and moves upwardly therethrough out of contact with the fabrics and is discharged over the upper open end 61. The liquid flowing through the openings 14 in the bottom wall 36 of the container 13 passes radially outwardly along the horizontal space 33, picks up or entrains the heavy sedimentary material as it moves rapidly over the surface, is directed to the inlet of the outer channel 58, by the curved surface 33, moves upwardly along this channel and is discharged over the top edge 12 of the imperforate receptacle. In this arrangement the liquid flowing in both channels is parallel, in the same direction and independent of each other.

From the foregoing it can be seen that an improved rotatable double tub construction for a washing machine has been provided which has an annular skirt disposed in the annular space between the two for directing washing liquid and sedimentary material upwardly and out of the tub through the annular channel out of contact with the fabrics being treated. Also, the annular space between the tubs is divided by means of the annular skirt to provide outer and inner channels and the inner channel may be sealed at its upper end so that all of the liquid in the tub is delivered to the outer channel adjacent the bottom of the tub to entrain sedimentary material collected thereat to remove the same during the

liquid extraction operation. In addition, the lower portion of the skirt is fluted to provide the inner channel with an exit area substantially equal to the entrance area of the outer channel.

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 of the invention.

It is claimed:

1. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract the liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly sloping side wall, a perforate container having a side wall disposed in said receptacle in spaced relation to define an annular liquid conducting space between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, and an annular member disposed in said annular space to provide inner and outer channels, said inner channel conducting liquid flowing through said perforate container, and said outer channel conducting liquid from the lower portion of said receptacle to its upper portion for discharge therefrom.

2. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract the liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly sloping side wall and a bottom wall, an open-ended perforate container having side and bottom walls disposed within said receptacle in spaced relation to define a liquid conducting space between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, and an imperforate member disposed in said space between said side walls to provide inner and outer channels, said inner channel conducting liquid flowing from said perforate container, and said outer channel conducting liquid from the bottom of said receptacle upwardly therethrough for discharge.

3. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract the liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly flaring side wall terminating in an upper open end and a bottom wall, an open-ended perforate container having side and bottom walls disposed within said receptacle, the side and bottom walls of said container and receptacle being spaced apart to define an annular liquid conducting space between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, an annular skirt disposed in said annular space between side walls to provide inner and outer channels, said skirt having a lower open end disposed adjacent the bottom of said receptacle in direct communication with the lower end of said outer channel and said outer channel conducting the liquid discharged from the inner channel over the upper open end of said receptacle when the same is rotated, and means carried at the upper end of said skirt cooperating with said container to seal said inner channel.

4. In a washing machine having a tub adapted

to receive liquid and fabrics to be washed and to be rotated to centrifugally extract the liquid from the fabrics, said tub comprising an imperforate receptacle having an upwardly and outwardly flaring side wall terminating in an upper edge, a container having a perforate side wall disposed within said receptacle in spaced relation to provide a liquid conducting space between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, and means carried in said space to divide the same into inner and outer liquid conducting channels, said inner channel directing the liquid flowing from said container toward the bottom of said receptacle and said outer channel directing the liquid discharged from said inner channel upwardly over the upper edge of said receptacle when the same is rotated.

5. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract the liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly flaring side wall terminating in an upper edge, a container having a perforate side wall disposed within said receptacle, said side walls being spaced to provide a liquid conducting space between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, a divider secured in said space having upper and lower ends to provide inner and outer channels, and means engaging said divider for closing said inner channel at its upper end to conduct liquid flowing through said side wall downwardly, said outer channel conducting the liquid flowing from said inner channel upwardly for discharge over the upper edge of said receptacle when the same is rotated.

6. In a washing machine having a tub adapted to receive liquid and fabrics to be washed and to be rotated to centrifugally extract the liquid from the fabrics, said tub comprising an imperforate receptacle having an upwardly and outwardly flaring side wall terminating in an upper edge, a container having a perforate side wall disposed within said receptacle in spaced relation to provide a liquid conducting space between said perforate container and said receptacle, a member having an imperforate cylindrical wall with upper and lower ends disposed in said annular space to divide the same into inner and outer annular channels, means cooperating with said container and cylindrical wall for sealing the upper end of said inner channel, said inner channel having a lower open end adjacent the bottom of said receptacle for discharging the liquid flowing through the perforate side wall of said container, said outer channel being in direct communication with said inner channel at the lower end of said cylindrical member for conducting the liquid entering the outer channel upwardly and over the upper edge of said receptacle when said tub is rotated during the extraction operation, and means for securing said cylindrical member and container to said receptacle.

7. In a washing machine having a tub adapted to receive liquid and fabrics to be washed and to be rotated to centrifugally extract the liquid from the fabrics, said tub comprising an imperforate receptacle having an upwardly and outwardly flaring side wall terminating in an upper open edge, a container having a perforate side

wall disposed within said receptacle in spaced relation to provide an annular liquid conducting space between said perforate container and said receptacle, an annular member having an imperforate cylindrical wall with upper and lower ends disposed in said space to divide the same into inner and outer annular liquid conducting channels, means carried at the upper end of said member for engaging said container to seal the upper end of said inner channel, said inner channel receiving the liquid flowing through the side wall of said container and discharging the same through its lower open end adjacent the bottom of said space, said outer channel being in direct communication with the inner channel at the lower end of said cylindrical member for conducting the liquid from the bottom of said space upwardly and over the upper edge of said receptacle when said tub is rotated, said cylindrical member having its lower portion fluted to provide substantially equal discharge and entrance areas at the lower portions of said channels, and means for securing said cylindrical member and said container to said receptacle.

8. In a washing machine having a tub adapted to receive liquid and fabrics to be washed and to be rotated to centrifugally extract the liquid from the fabrics, said tub comprising an imperforate receptacle having a bottom wall and an upwardly and outwardly flaring side wall terminating in an upper open edge, a container having perforate side and bottom walls disposed within said receptacle in spaced relation to the walls in said receptacle to provide an annular liquid conducting space between said perforate container and said receptacle for collecting sedimentary material, an annular member having an imperforate cylindrical wall with upper and lower ends disposed in the annular space between the side walls of said container and receptacle to divide the same into the inner and outer liquid conducting channels, said cylindrical wall having its lower edge disposed adjacent the bottom wall of said receptacle and being fluted to provide generally equal areas for said channels, means for sealing the upper end of said inner channel above the normal liquid level in said receptacle, said inner channel receiving the liquid flowing through the side wall of said container and discharging the same through its lower end adjacent the bottom of said space, said outer channel being in direct communication with the space at the bottom of said receptacle for conducting the liquid and sedimentary material delivered thereto upwardly therethrough and over the top edge of said receptacle when said tub is rotated, and means for securing said cylindrical member, container and receptacle together to form a unitary structure.

9. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly sloping side wall with an open upper edge and a bottom wall, an open ended perforate container having side and bottom walls disposed within said receptacle, said side and bottom walls of said container and receptacle being spaced apart to define upper and lower annular liquid conducting spaces between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, an annular skirt having upper and lower ends dis-

posed in said upper annular space between said side walls to provide inner and outer liquid conducting channels with the lower end of said skirt being disposed adjacent the bottom wall of said receptacle to provide an exit for said inner channel and an entrance for said outer channel, said skirt having its lower portion fluted to provide substantially equal exit and entrance areas, and means for holding said skirt in spaced relation within said upper annular space.

10. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly sloping side wall, a container having a perforate side wall disposed in said receptacle in spaced relation to define an annular liquid conducting space between said perforate container and said receptacle, means for securing said receptacle and container together to form a unitary structure, a downwardly and outwardly flaring annular member having upper and lower ends disposed in said space to provide inner and outer annular liquid conducting channels, the lower end of said member defining the exit for said inner channel and the entrance to said outer channel, said lower end being further convoluted to provide an increased angle for liquid flow out of said inner channel and to maintain substantially equal exit and entrance areas at the lower portion of said channels, and means for holding said member in spaced relation within said annular space.

11. A tub for a washing machine adapted to receive liquid and fabrics to be washed and to be rotated about a vertical axis to extract liquid therefrom, comprising an imperforate receptacle having an upwardly and outwardly flaring side wall terminating in an upper open end and a bottom wall, an open ended container having perforate side and bottom walls disposed within said receptacle, said side and bottom walls of said receptacle and container being spaced apart to define an annular liquid conducting space between said perforate container and said receptacle, an annular imperforate skirt having upper and lower ends disposed in said annular space between said side walls and substantially parallel with the side wall of said receptacle to provide inner and outer channels, said skirt having its upper end above the upper edge of said receptacle and its lower end disposed adjacent the bottom of said space, said inner channel conducting the liquid passing through the perforate side wall of said container upwardly to discharge the same over its upper end when the tub is rotated and said outer channel conducting the liquid passing through the bottom of said container upwardly and parallel to the liquid flowing through said inner channel, and means for securing said skirt, container and receptacle together to form a unitary structure.

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