

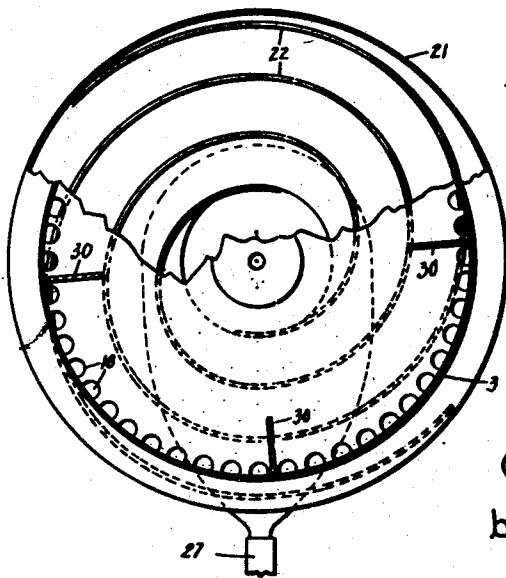
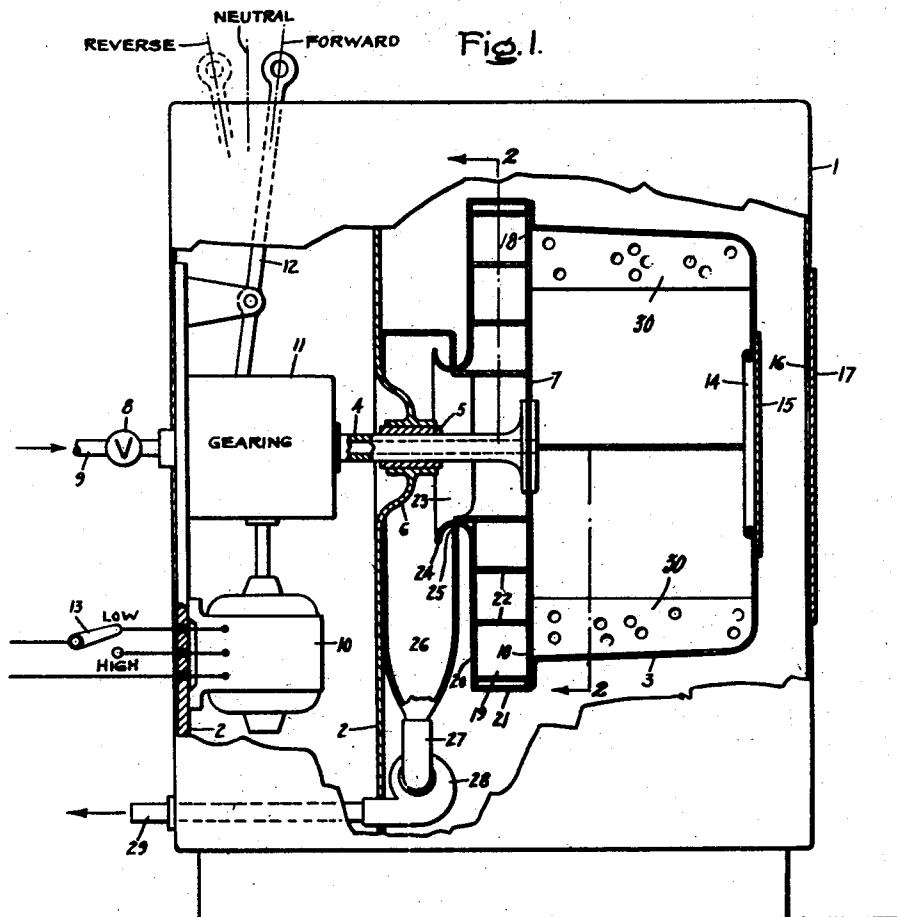
July 17, 1951

G. W. DUNHAM
WASHING MACHINE

2,561,186

Filed Feb. 4, 1943

2 Sheets-Sheet 1



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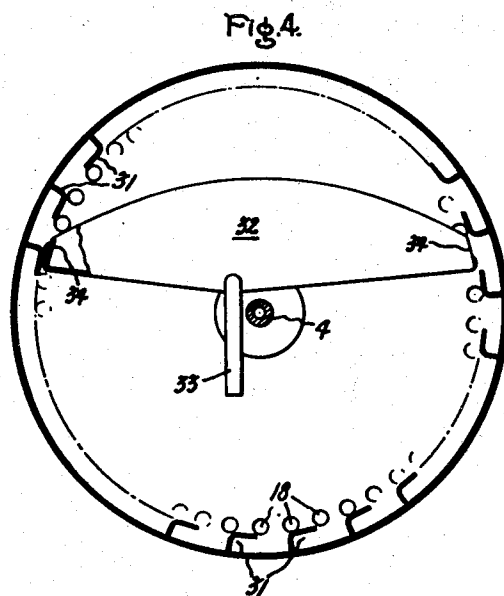
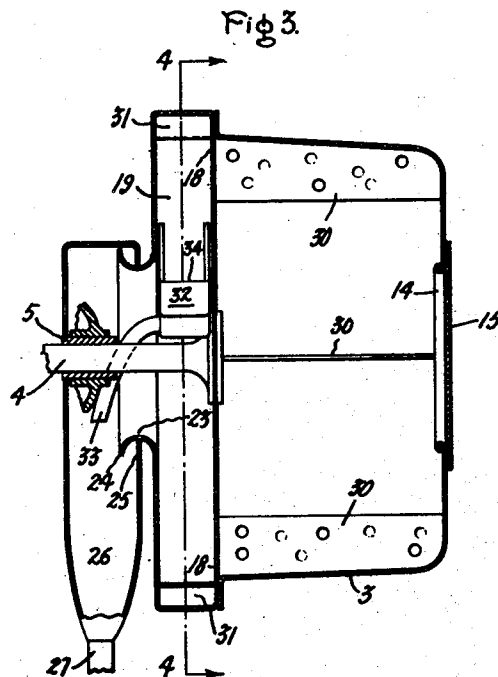
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WASHING MACHINE

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3 Claims. (Cl. 68—24)

1

The present invention relates to cylinder washing machines.

In such machines the clothes are washed in a tub supported on its side for rotation about a more or less horizontal axis. During washing, the tub is rotated at a speed such that the force of gravity is greater than centrifugal force. The washing solution accordingly is held by gravity in the lower most segment of the tub, and the clothes in frictional contact with the side walls of the tub are lifted out of the washing solution by rotation of the tub and dropped or tumbled into the washing solution as the clothes reach the uppermost position. To increase the height from which the clothes are tumbled into the washing solution, the side walls of the tub may be provided with projections which have a better grip on the clothes. The clothes may be centrifugally dried by rotating the tub at a higher speed, at which centrifugal force is greater than gravity.

The object of my invention is to provide an improved construction in which the washing, centrifugal drying, and emptying of the tub are selectively controlled by the speed and direction of rotation of the tub. For a consideration of what I believe novel and my invention, attention is directed to the following description and the claims appended thereto.

In the accompanying drawing, Fig. 1 is an elevation, partly broken away, of a washing machine embodying my invention; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; Fig. 3 is a side elevation of a modification; and Fig. 4 is a sectional view taken on line 4—4 of Fig. 3.

Referring to the drawing, there is shown a washing machine having an outer casing or enclosure 1 within which is mounted a frame 2 supporting a cylindrical tub 3 for rotation on a horizontal axis. The tub is supported by a hollow shaft 4 journaled at 5 in a dish portion 6 of the frame and fixed to a partition 7 extending across the back end of the tub. The shaft has a suitable connection through a valve 8 with a water supply pipe 9 so that water may be conducted through the shaft to the center of the tub. The shaft is driven by a two-speed electric motor 10 through gearing 11 having a gear shift lever 12 for shifting to forward, neutral, and reverse. The speed of the motor is controlled by a switch 13. By means of the gear shift lever and the switch 13, the shaft, and accordingly the tub which is fixed thereto, may be driven at low or high speeds in both forward and reverse directions. At the front end of the tub is a cen-

2

tral opening 14 closed by a cover 15 through which clothes may be loaded and unloaded. The opening 14 is in line with a similar slightly larger opening 16 in the outer casing which is closed by a cover 17. The portion of the tub between the front side of the partition 7 and the cover 15 constitutes the washing compartment. When the cover 15 is in place, it makes a liquid-tight seal of the opening 14, and the only drainage from the washing compartment is through perforations 18 arranged around the periphery of the side walls of the tub in the partition 7. As indicated in the drawing, the side walls and the tub are preferably tapered so that all of the liquid in the tub will drain through the perforations. The perforations 18 are small enough to keep the clothes in the washing compartment.

On the rear side of the partition 7 is an annular compartment 19, of somewhat greater diameter than the washing compartment of the tub, and formed by a rear wall 20 fixed to a peripheral flange 21 integral with the partition 7. Between the partition 7 and the rear wall 20 are fixed spiral vanes 22 having outer ends adjacent the flange 21, and inner ends overlapping a central opening 23 in the wall 20. The opening 23 surrounds the shaft 4 and is provided with an outwardly flaring mouth 24 which overlaps a concentric opening 25 in a chamber 26, the lower end of which is connected to the inlet 27 of a pump 28. The pump inlet chamber 26 has top, side, and end walls completely surrounding the mouth 24 of the outlet 23 so as to prevent splashing. The spiral vanes 22 provide passages having outer ends facing in a counterclockwise direction, as viewed in Fig. 2. These passages are inclined toward the outer walls of the tub, and, during rotation of the tub in a counterclockwise direction (Fig. 2), serve as scoops for picking up liquid draining through the perforations 18 into the compartment 19. The liquid picked up by the vanes during this rotation of the tub will drain by gravity from the inner ends of the spiral passages through the opening 23 into the compartment 26, from which it may either drain by gravity or be pumped through a pipe 29 to a drain. Obviously, for effective pumping operation of the vanes 22 the speed of rotation must be such that centrifugal force on the liquid in the passages defined by the vanes is less than gravity, as otherwise the liquid would merely be held by centrifugal force in an annular ring at the outer ends of the passages. During rotation of the tub in the reverse direction (clockwise as viewed in Fig. 2), the vanes 22 will not

3

be effective to remove or pump liquid from the tub.

In the use of the machine, the clothes are loaded into the tub through the openings 14 and 16, and the tub is filled by opening the valve 8. When the liquid level in the tub reaches the opening 23, liquid will flow out of the tub through this opening to the pump inlet chamber 26, and this may serve as an indication that the tub is filled to the proper level. The gear shift lever 12 is then moved to the forward position, and the switch 13 is moved to the low speed position, causing rotation of the tub in a clockwise direction (Fig. 2) at washing speed. During washing, the liquid will be held by gravity in the lowermost segment of the tub, and the clothes will be lifted out of the liquid by suitable projections on the side walls of the tub, such as perforated ribs 30, and dropped or tumbled into the liquid as the ribs approach the vertical position, thus producing the characteristic washing action of the cylinder washing machine. At the end of the washing operation the gear shift lever 12 is shifted to reverse, causing rotation of the tub in a counterclockwise direction. During counterclockwise rotation of the tub the vanes 22 are effective to elevate liquid from the lowermost part of the compartment 19 and discharge it into the pump inlet chamber 26 through the opening 23, whence it is pumped to a drain. The counterclockwise rotation of the tub is continued until all of the liquid is drained. At this point there will be a considerable amount of washing solution absorbed in the clothes. Some of this may be removed by shifting the switch 13 to the high speed position, causing high speed rotation of the tub, which centrifugally extracts the washing solution from the clothes. At the start of the high speed rotation, the clothes will be tumbled in the same manner as during washing. As the speed of rotation increases, centrifugal force becomes predominant and the clothes are moved radially outward to form an annular layer on the side walls of the tub. The centrifugally extracted liquid will be discharged to the compartment 19 through the perforations 18 and will be centrifugally held in an annular ring at the outer part of the compartment 19 so long as the tub is rotated at a speed at which centrifugal force exceeds the force of gravity. When the tub slows down, due either to opening of the switch 13 or to movement of the gear shift lever to the neutral position, either with or without additional braking action, the liquid centrifugally held in the outer part of the compartment 19 will drain by gravity into the pump inlet chamber 26. The compartment 19 has sufficient volume radially outside of the washing compartment to accommodate all of the liquid extracted from the clothes during centrifugal drying. If it has sufficient additional space, it is possible to spray-rinse the clothes during centrifugal drying by opening the valve 8 and admitting fresh water. This fresh water will be centrifugally forced through the clothes and will remove absorbed washing solution. While spray-rinsing is possible, it is generally preferable that the rinsing be carried out while the tub is being rotated at its slow or washing speed in either a clockwise or counterclockwise direction. If the tub is rotating in a clockwise direction, it will be filled with fresh water and the clothes will be tumbled in the same manner as during washing. With counterclockwise rotation the valve 8 will be opened to continually admit water and the clothes will be tumbled, but the water

4

in the lowermost part of the tub will be continually withdrawn by the pumping action of the vanes 22. With either type of slow speed rinse, the tumbling of the clothes aids in securing a thorough impregnation of the clothes with fresh water, and the agitation of the clothes due to the tumbling is effective in removing lint and solid particles such as the reaction products of soap. Following the rinsing, the clothes may be subjected to a final centrifugal drying operation as described above.

The modification shown in Figs. 3 and 4 is similar to the previously described construction, corresponding parts being designated by the same reference numerals. The spiral vanes 22 have been replaced by an annular series of scoops 31 in the outer part of the compartment 19 which face in a counterclockwise direction (Fig. 4) so that during rotation of the tub in that direction at washing speed (a speed at which gravity is less than centrifugal force) the scoops pick up water from the lowermost segment of the annular compartment 19 and empty into a trough 32 having a drain conduit 33 leading to the pump inlet chamber 26 or any other suitable place of disposal. Due to the clearance between the side walls of the trough 32 and the walls of the compartment 19 not all of the water emptied from the scoops 31 will fall into the trough. This does not interfere with the operation. During reverse rotation of the tub the scoops are ineffective. The trough 32 is provided with lips 34 having a running clearance with the inner edges of the scoops 31. During rotation of the tub at centrifugal drying speed the water is centrifugally held in an annular ring in the compartment 19 and the lips 34 act to deflect water from the inner surface of the ring to the trough 32. As the tub slows down from its centrifugal drying speed to a speed at which gravity is greater than centrifugal force, the water falls by gravity, part into the trough 32 and the rest into the lowermost segment of the compartment 19 from which it will be immediately picked up by the scoops 31 and emptied into the trough if the tub is rotating in a counterclockwise direction. If the tub is rotating in a clockwise direction the water will remain in the lowermost segment of the compartment 19, but this compartment can be so proportioned that the water level will not rise above the perforations 18 and wet the centrifugally dried clothes.

In the use of the machine illustrated in Figs. 3 and 4, the clothes are loaded into the tub through the openings 14 and 16 and the tub is filled through the hollow shaft 4. When the liquid level in the tub reaches the opening 23, liquid will flow out of the tub through this opening to the pump inlet chamber 26 indicating that the tub is filled to the proper level. The tub is then rotated in a clockwise direction at the slow speed for washing, in a counterclockwise direction at the same speed to empty the tub, and in a counterclockwise direction at a high speed for centrifugal drying. During centrifugal drying, rinse water may be discharged into the tub through the hollow shaft 4 to spray rinse the clothes. The rinse water will be moved by centrifugal force into the compartment 19 and held therein in an annular ring covering the scoops 31. When the water builds up to a level sufficient to contact the lips 34 of the trough 32 the excess liquid is deflected into the trough. Because of this feature the spray rinsing may be carried out with either direction of rotation. As with the previously described construction,

it is also possible to rinse the clothes while the tub is rotating at washing speed in either direction. When the tub rotates in a clockwise direction the tub is filled with water and the clothes are tumbled in the same manner as during washing. When the tub rotates in a counterclockwise direction the water is continually emptied by the scoops 31 so that the rinsing operation is more nearly a spray rinse.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a washing machine, walls defining a tub for the reception of clothes and cleaning fluid, a shaft which supports the tub for rotation about a horizontal axis, means in the tub for effecting washing when the tub is rotated about its axis, outer end and side walls attached to an end wall of the tub which define a compartment at such end of the tub of greater diameter than the tub whereby the peripheral portion of such compartment defines an annular pocket radially beyond the tub for reception of liquid, the end wall of the tub adjacent to said compartment being provided at its periphery with openings which connect the tub with said compartment at points spaced radially inward from the outer side wall of said compartment and said outer compartment being provided with a central discharge opening, liquid directing walls in the compartment which define means all facing in one direction which when the tub is rotated in such one direction direct liquid from said annular pocket toward the central portion of said compartment, walls at the central portion of said compartment which define means which receives liquid from said liquid directing walls and guides it to said discharge opening, a motor, and means connecting the motor to the tub to effect rotation of the tub in one direction at a speed such that centrifugal force at the periphery of the tub is less than gravity for washing and to effect rotation of the tub in the other direction at a lower speed to effect discharge of liquid through said central discharge opening in the outer wall and at higher speed to centrifugally extract liquid from the clothes.

2. In a washing machine, a cylinder having side and end walls provided with a partition adjacent to one end wall which divides the cylinder into a washing chamber and an end compartment of greater diameter than the washing chamber, said partition having openings at its periphery which connect the washing chamber to the compartment at points spaced inwardly from the periphery of the compartment whereby there is provided an annular pocket at the periphery of the compartment beyond such openings, the end wall at the end of the cylinder remote from the compartment having an opening through which clothes to be washed may be put into the washing chamber and a closure for said opening, and the end wall at the other end of the cylinder having a discharge opening, clothes washing means in the washing chamber to effect washing of the clothes when the cylinder is rotated, a shaft on which the cylinder is supported for rotation about a horizontal axis, a series of scoops in said annular pocket facing in one direction of rotation for elevating liquid, walls defining a trough at the upper portion of said compartment into which said scoops discharge liquid and from which the liquid is di-

rected to said discharge opening, a motor, and means connecting the motor to the cylinder for rotating the cylinder at slow speed in one direction for washing and at slow speed in the other direction for emptying the washing chamber and at higher speed in said other direction for centrifugally extracting liquid from clothes in the washing chamber.

3. A laundry machine comprising a substantially imperforate drum journaled for rotation about an axis out of the vertical and having a central discharge passage at one end thereof, means for rotating said drum at a washing speed and at a higher centrifuging speed, a laundry-containing chamber in said drum, a liquid-collecting chamber in said drum at the discharge passage end thereof and communicating with said laundry chamber and having a diameter greater than the diameter of said laundry chamber, said collecting chamber having a storage capacity beyond the periphery of said laundry chamber sufficient to accommodate the liquid extracted by centrifuging from a load of laundry in the laundry chamber after initially draining the free liquid from said load, and means rigid with said drum and operable upon rotation of said drum at said washing speed for removing liquid from said collecting chamber and delivering it into said discharge passage, said collecting chamber being of such construction and so related to said laundry chamber and said liquid removing means that said collecting chamber will be operative to collect liquid therein from the laundry chamber for removal at washing speed of rotation of said drum when draining the free liquid from said laundry chamber, and to collect and retain centrifugally extracted water for removal as the drum slows down from centrifuging speed.

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