Aug. 3, 1965 R. R. WALTON 3,197,791

METHOD OF AGITATING CLOTHES

Original Filed July 18, 1963 2 Sheets-Sheet 1

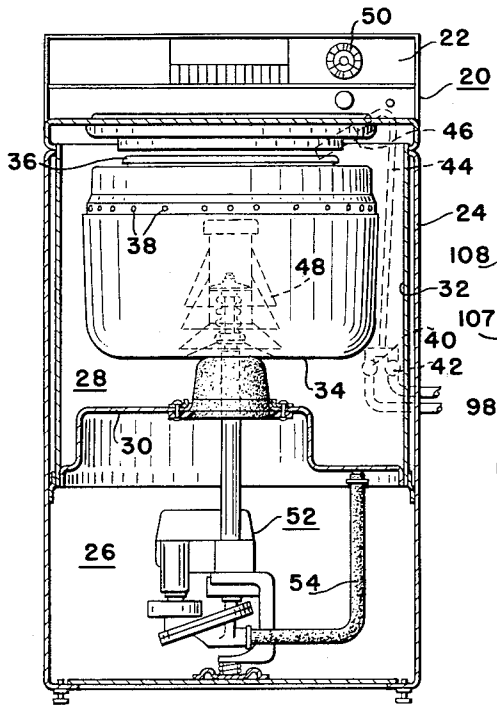

Fig. 1

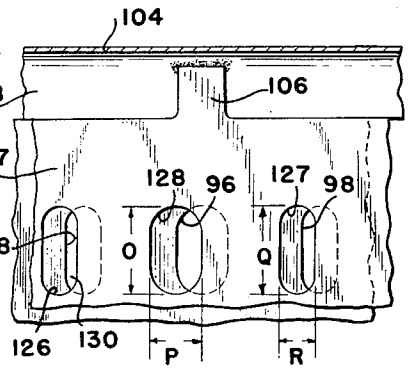

Fig. 5

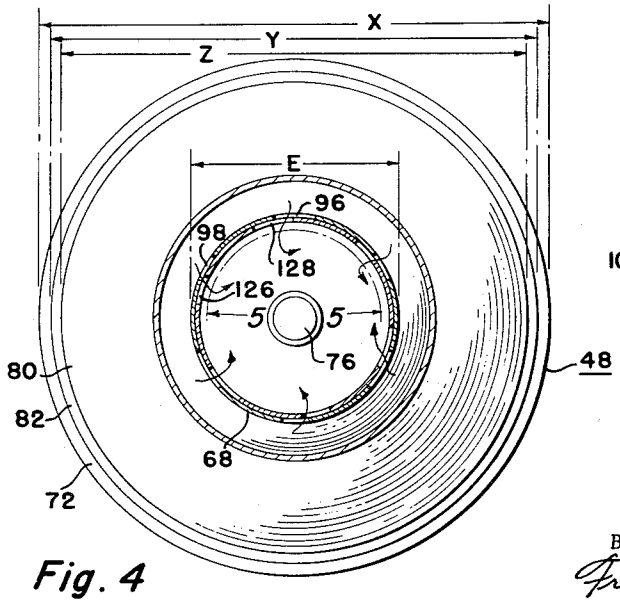

Fig. 4

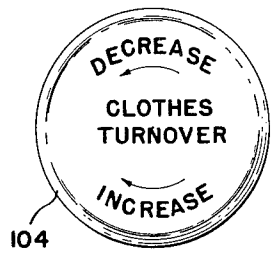

Fig. 3

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METHOD OF AGITATING CLOTHES

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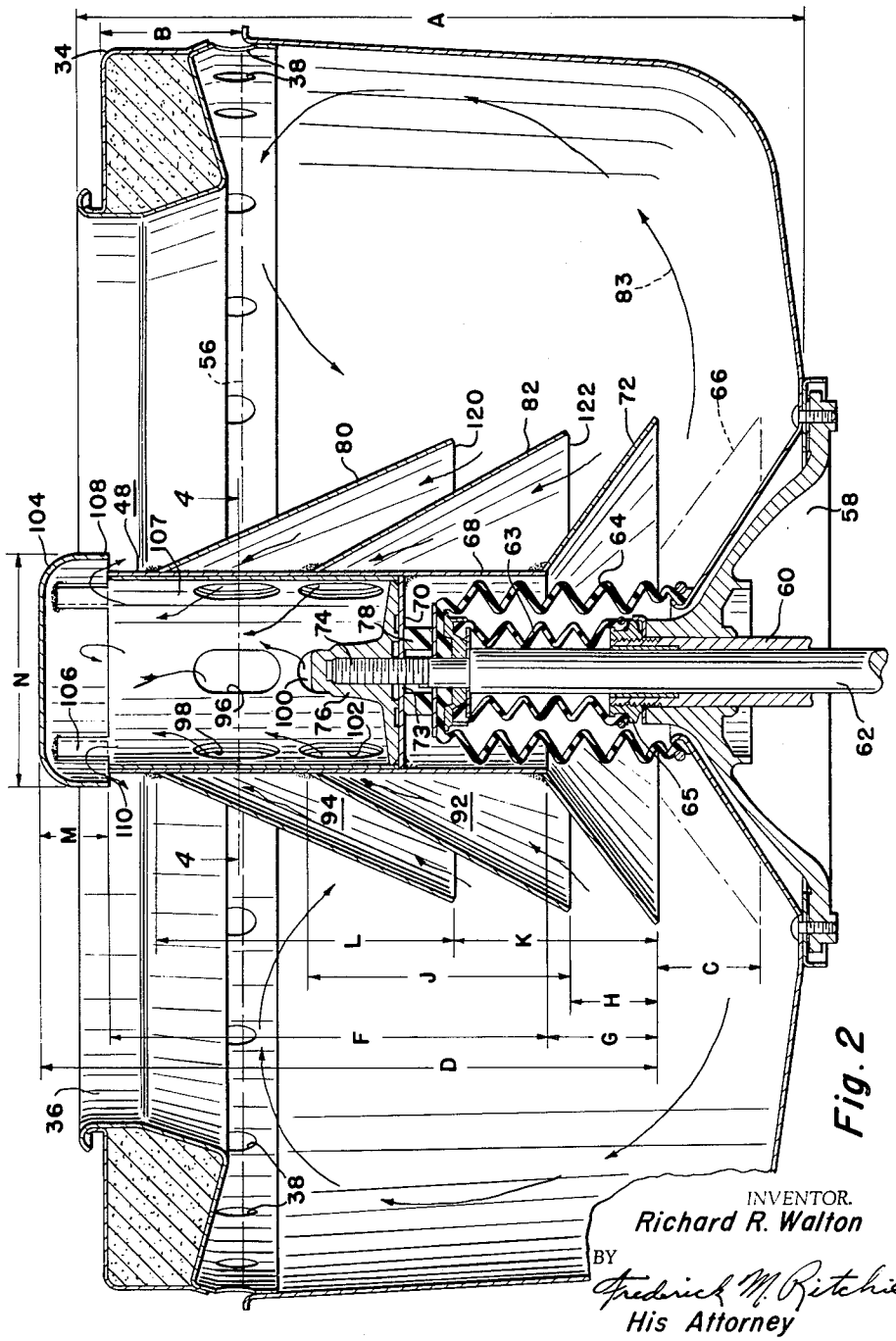

Fig. 2

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METHOD OF AGITATING CLOTHES

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Original application July 18, 1963, Ser. No. 295,952, now Patent No. 3,132,502, dated May 12, 1964. Divided and this application Jan. 29, 1964, Ser. No. 341,047

4 Claims. (Cl. 8—159)

This invention relates to a domestic appliance and more particularly to a new method of vertically reciprocatingly agitating in a clothes washer and is a division of my copending application Serial No. 295,952 filed July 18, 1963, now Patent 3,132,502 issued May 12, 1964.

One type of domestic clothes washer uses vertical reciprocation for washing clothes wherein an agitator is attached to the top of a vertically reciprocable power shaft for movement in a water filled tub. As the agitator moves up and down, toroidal water currents are produced in the tub which cause the clothes to turn over and over—the flexing of the clothes in the presence of the surging currents serving to effect a cleaning process.

Clothes tangling has been a troublesome problem in prior art clothes washers of this type and such problems probably existed due to the different orbiting speeds between the clothes and the washing fluid. Where the clothes are turning over in a restricted area at the radially outer portion of the tub and the water is toroidally circulating throughout the entire tub, relative movement is set up between different garments in the tub and an intertwining or tangling condition results. This invention is directed to a novel agitator for use with vertical reciprocation which overcomes these and other problems.

Accordingly, it is an object of this invention to provide a vertically reciprocable clothes washer agitator which eliminates the problem of clothes tangling.

It is another object of this invention to provide a clothes washer agitator adapted for vertical reciprocation and including a hollow column, a pump ring below the column for producing toroidal currents in response to vertical reciprocation, and a pair of elongated, frusto-conical clothes actuator rings on said column above said pump ring for ratcheting the clothes in an orbital path, the space formed between the column and each of said clothes actuator rings being vented to atmosphere through the hollow column.

It is a still further object of this invention to provide in the above clothes washer agitator adjustable means for venting the space between the column and the clothes, whereby varying the amount of venting to atmosphere controls the rate of clothes turnover.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a schematic sectional view, partly in elevation, of a clothes washer provided with the new clothes agitator of this invention;

FIGURE 2 is an enlarged sectional view of a clothes washer spin tub in combination with the agitator of this invention showing the circulating currents obtainable with this invention;

FIGURE 3 is a top elevational view of the agitator cap usable as a clothes turnover adjustment means;

FIGURE 4 is a sectional view taken along line 4—4 in FIGURE 2; and

FIGURE 5 is a view taken along line 5—5 in FIGURE 4 to illustrate the manner in which surge pressures are variably relieved, thereby to adjust clothes turnover.

In accordance with this invention and with reference to FIGURE 1, a clothes washer 20 is comprised of a control housing portion 22 and an outer cabinet or casing 24. The casing 24 is generally divided into a mechanism portion or compartment 26 and a washing portion or water container chamber 28. A generally centrally located bulkhead 30 separates the mechanism compartment 26 from the water container chamber 28 which is further bounded by a cylindrical water container wall 32. Within the water container 32 is a spin tub 34 having a top opening 36 and a plurality of centrifuging outflow ports 38. The ports 38 are designed to permit egress of water from the tub 34 when the tub is rotated at high speed. For filling the tub 34 with water, a conventional water supply system may be provided with a hot water solenoid actuated valve 40 and a cold water solenoid actuated valve 42, both of which are manifolded into a mixed water supply conduit 44 leading to a chute 46 which overlies the opening 36 of the tub. Within the tub 34, an agitator or pulsator 48 is adapted to reciprocate for producing toroidal circulation of water in the tub and for agitating cloths therein. Thus, clothing placed within the tub 34 is washed as the agitator 48 forces surging currents of washing fluid and detergent through the fabric. Conventional sequentially operating timer means, shown generally at 50 on the control housing 22, may be included to selectively admit water through the supply conduit 44, to spin the tub 34 and to vertically reciprocate the agitator 48.

A prime moving system, shown generally at 52, in the mechanism compartment 26 is adapted to selectively rotate the tub 34 and reciprocate the agitator 48. Two agitating and spinning mechanisms suitable for such selective use with this invention are shown in the patents to Sisson 2,987,904, issued June 13, 1961, and to Brucken 3,087,321, issued April 30, 1963. Such mechanisms may be designed for agitate speeds of 330 and 220 1.75-inch strokes per minute with spin speeds of 710 and 465 revolutions per minute. In addition to selectively operating the spin tub and the agitator, the agitating and spinning mechanism 52 includes a pump for draining the water container 32 through the drain conduit 54.

Turning now to FIGURE 2, the novel agitator 48 of this invention is shown installed in a spin tub 34 having the following dimensions. The overall height A is $12\frac{23}{32}$ inches and the distance B from the top of the ballast ring to the fluid level 56 in the tub is $2\frac{35}{64}$ inches. The outer diameter of the tub 34 at its greatest point, not counting the small out-turned flange adjacent the outflow ports 38, is 21½ inches. For strengthening thereof the tub 34 is affixedly supported on an annular casting 58 which is affixed to the spin shaft portion 60 of the agitating and spinning mechanism 52. The vertically reciprocable agitator shaft 62 extends through the spin shaft 60 and the tub support casting 58 into the tub where it is adapted to receive the agitator 48. A concentric bellows arrangement includes a water seal bellows 64 and an oil seal bellows 63 which interconnect the bottom of the tub 34 and the tub mounting nut 65 in a manner to provide a water seal to prevent water from reaching the mechanism and an oil seal to prevent oil from reaching the inside of the tub. The agitator 48 is shown in its uppermost position in FIGURE 2—its lowermost position being shown by the phantom line indication 66. The length of stroke C traveled by the agitator 48 is 1.75 inches.

The agitator 48 is comprised of a cylindrical hollow column portion 68 having an affixed central partition 70 and an out-turned generally frusto-conical pump ring 72 at the bottom thereof. The partition 70 has a central opening 73 through which the threaded end 74 of the agitator shaft extends. A column mounting nut 76 threads

onto the top of the agitator shaft—a nylon spacer 78 being provided to hold the frusto-conical ring 72, in its lowermost position, at the proper distance from the bottom of the tub 34. On the outside of the cylindrical column 68 is an upper generally frusto-conical clothes actuator ring 80 and immediately therebelow a lower generally frusto-conical clothes actuator ring 82. In general, the pump ring 72 serves to produce toroidal circulation of water, as shown by the water flow arrows 83, while the upper clothes actuator rings 80 and 82 nudge the clothes portions adjacent thereto in rather a ratcheting or pulsatingly submerging manner to tuck these clothes portions downwardly as they rollingly move inwardly toward the agitator.

In view of the vertical spacing between the three rings on the agitator 48, downwardly opening annular surge pressure chambers are formed. For instance, between the pump ring 72 and the lower clothes actuator ring 82 a lower surge pressure chamber 92 is formed; and between the lower clothes actuator ring 82 and the upper clothes actuator ring 80 an upper surge pressure chamber 94 is formed.

When the agitator 48 is reciprocated, water or washing fluid and entrained air from the tub 34 surges into and out of confined areas like the surge chambers 92 and 94. Washing fluid is not normally compressable in such surge chambers and thus the tendency is for the washing fluid to back out of the chambers, thereby preventing the clothes from coming into close actuatable engagement with the clothes actuator rings of the agitator. This further results in the clothes orbiting in a tight toroidal fashion in a small portion of the cross section of the tub adjacent its radially outer side. It is an object of this invention to relieve or reduce the pressures built up between the rings on the agitator, thereby creating a suction or pressure relief zone between the rings rather than a pressure zone—said sucking action serving to draw clothes toward the agitator rather than repelling them so that the clothes actuator rings 80 and 82 can pulsatingly submerge the clothes coming in contact therewith. This action causes the clothes to turnover throughout the same cross section of the tub utilized by the washing fluid, i.e., the entire cross section. When the clothes orbit along the same path traveled by the washing fluid, there is no tendency to tangle. For accomplishing the foregoing results, the novel no-tangle concept of vertical clothes agitation is embodied in structure which relieves to atmosphere those fluid pressures built-up in the chambers between the rings by the surging thereinto of washing fluid.

The atmospheric venting arrangement is effected with three relatively wide elongated slots 96 and three relatively narrow elongated slots 98 in the column 68 of the agitator communicating the upper surge relief chamber 94 with the hollow of the agitator column. Similarly and immediately below the upper slots, three relatively wide elongated slots 100 and three relatively narrow elongated slots 102 connect the lower surge relief chamber 92 with the hollow of the agitator column. The relatively wide and relatively narrow slots on both levels of the agitator may be alternately positioned with each other around the circumference of the agitator column.

An agitator cap 104 is supported on upstanding tabs 106 extending from the upper end of a turnover adjustment cylinder 107 which nests into the agitator column 68, thereby positioning the radially outer peripheral edge 108 of the cap a spaced distance from the column to form an annular vent passageway 110 connected to atmosphere completely around the cap. The adjustment sleeve 107 has turnover adjustment slots such as 126, 128 (FIGURE 5) which may be selectively indexed with adjacent slots such as 96, 98 in the cylindrical agitator column to relieve to atmosphere those pressures built up under the clothes actuator rings 80 and 82.

In a clothes washer, the agitator 48 operates as follows. When the agitate shaft 62 is vertically reciprocating and more particularly during a down stroke of 1.75 inches, the pump ring 72 initiates a toroidal circulation of washing fluid in the tub 34. Powerfully surging currents of water and detergent are forced through the reticulations of the cloth fabric adjacent thereto to clean the fabric as the clothes are rolled over and over along side the agitator. Also on the down stroke washing fluid and entrained air will be caused to rush into the surge relief chambers 92 and 94 underneath the clothes actuator rings. These surging currents of air and fluid then burst into the hollow of the column 68 through the slots, such as 96, 98, 100 and 102, adjacent their respective surge chambers. From the hollow of the column 68 the pressures attendant such surging currents are then relieved completely to atmosphere by way of the annular passageway 110. As these surge pressures are relieved, a suction or reduced pressure zone is created adjacent the peripheral edges 120 and 122 of the upper and lower clothes actuator rings respectively. It is this sucking action along the radially inner diameter of the toroid of circulating washing fluid which draws the clothes into touching engagement with the actuator rings and holds them there during the down stroke of the agitator, thereby to pulsatingly submerge or downwardly ratchet the clothes toward the pump ring. On the upstroke of the agitator the sucking action ceases so that the agitator can return upwardly relative to the clothes prior to its next succeeding ratchet-like actuation of the clothes.

In accordance with another aspect of this invention, the rate of turnover of clothes in the tub is made adjustable. This is accomplished by the manual manipulation of the cap 104 in the manner suggested by the cap indicia (FIGURE 3). Since the cap 104 is carried at the upper end of the sleeve 107, relative rotation of the cap will laterally displace adjusting sleeve slots 126 from column slots 98, thereby to reduce the size of the relief opening such as 130 (FIGURE 5) to form a restriction in the passageway leading to atmosphere. As the opening is restricted, the clothes turnover is reduced. Such an adjustment finds utility in the washing of delicate fabrics for which a minimum of flexing is desirable.

With reference to FIGURES 2, 4 and 5, a preferred agitator 48 built in accordance with the concepts of this invention has the following dimensions. The overall height D of the agitator is $10\frac{25}{32}$ inches. The outside diameter E of the agitator column 68 is 3¼ inches and its height F is 7⅝ inches. The lower frusto-conical pump ring 72 has a height G of 2 inches and a maximum diameter X of $8\frac{13}{16}$ inches. Although the pump ring 72 is shown as a sheet metal addition to the cylindrical column 68, this ring could be formed of a yieldable material, such as neoprene or urethane in order to minimize overload problems which could occur where clothes are caught between the bottom of the tube 34 and the pump ring 72.

The lower clothes actuator ring 82 is positioned with its peripheral edge 122 a distance H of $1\frac{9}{16}$ inches above the bottom of the agitator and is formed as a frusto-conical member having a height J of 4⅜ inches and a diameter Y at its lower edge 122 of $8\frac{7}{16}$ inches.

The upper clothes actuator ring 80 is positioned on the column 68 with its lower edge 120 a distance K of $3\frac{9}{16}$ inches above the bottom of the agitator and is formed as a frusto-conical cone having a height L of 5 inches and a maximum diameter Z at its peripheral edge 120 of $8\frac{1}{16}$ inches.

The cap 104 has a height M of $1\frac{3}{16}$ inches and a diameter N of 4 inches. The sleeve 107 carried by the cap has a diameter just sufficiently smaller than the column housing 68 so that the two members will fit in closely nested relationship to each other.

The large vent relief ports, such as 96 in the column 68 and 128 in the adjustment sleeve 107 have a height O of 1½ inches and a width P of ¾ inch whereas the small slots, such as 98 in the column housing 68 and 127 in the adjustment sleeve have a height Q of 1½ inches and a width R of ½ inch.

It has long been known that vertical reciprocation provides the best cleaning method for fabrics. The clothes are not dragged back and fourth but are circulated in a toroidal or orbiting path in a manner whereby the flexing fabrics are presented preiodically to surging currents of wash water and detergent for release of the soil therefrom. The tendency of prior art devices of this type to tangle clothes has been overcome by the agitator of this invention which not only provides in a single unitary device means to initiate the surging washing currents, but includes also means for ratcheting the clothes in an orbiting path, said ratcheting means made effective by the release to atmosphere of surge pressures in the vicinity of the ratcheting means. Such action provides for a continuous, constant rate presentation of clothes to the surging wash currents of the pump ring and results in clothes moving throughout the entire cross section of the tub at speeds in relation to the washing fluid which will not cause clothes to tangle.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other form might be adopted.

What is claimed is:

1. The method of vertically reciprocatingly agitating clothes in a fluid without tangling comprising the steps of, initiating a toroidal circulation of said fluid, introducing clothes to said toroidal circulation of fluid along the inner diameter of said toroidal circulation, ratchetingly submerging said clothes in said fluid at the inner diameter of said toroidal circulation, and substantially completely venting directly to atmosphere those pressures at the point where said clothes are being ratchetingly submerged for maintaining the continuous ratcheting submergence of said clothes and the homogeneous toroidal circulation thereof.

2. The method of linearly reciprocatingly agitating clothes in a fluid without tangling comprising the steps of, initiating a toroidal circulation of said fluid, introducing clothes to said toroidal circulation of fluid along the inner diameter of said toroidal circulation, ratchetingly submerging said clothes in said fluid at the inner diameter of said toroidal circulation, and substantially completely venting directly to atmosphere those pressures at the point

where said clothes are being ratchetingly submerged for maintaining the continuous ratcheting submergence of said clothes and the homogeneous toroidal circulation thereof.

3. The method of vertically reciprocatingly agitating clothes in a fluid without tangling comprising the steps of, initiating a toroidal circulation of said fluid, introducing clothes to said toroidal circulation of fluid along the inner diameter of said toroidal circulation, pulsatingly submerging said clothes in said fluid at the inner diameter of said toroidal circulation, and selectively adjustably venting to atmosphere those pressures at the point where said clothes are being pulsatingly submerged for varying the amount of continuous pulsating submergence of said clothes in accordance with the desired rate of clothes turnover.

4. The method of linearly reciprocatingly agitating clothes in a fluid without tangling comprising the steps of, initiating a toroidal circulation of said fluid, introducing clothes to said toroidal circulation of fluid along the inner diameter of said toroidal circulation, pulsatingly submerging said clothes in said fluid at the inner diameter of said toroidal circulation, and selectively adjustably venting to atmosphere those pressures at the point where said clothes are being pulsatingly submerged for varying the amount of continuous pulsating submergence of said clothes in accordance with the desired rate of clothes turnover.

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