

WASHING MACHINE

This invention relates to a washing machine having a construction that detergent is reserved in a wash tub without being in contact with clothes to be washed.

Conventionally, some types of washing machines are
5 provided with a function of previously setting a washing operation completion time, which will hereafter be referred to as "a washing operation completion time presetting function" throughout the description. In such washing machines, a long interval is sometimes left between the
10 loading of clothes with detergent dispensed and the actual starting of the washing operation. Also, in the case of other types of washing machines not provided with the above-mentioned washing operation completion time presetting function, the washing machines are sometimes left for some
15 time after loaded with clothes with detergent dispensed for operator's inconvenience or other reasons. In these cases, when the detergent is in contact with the clothes in the wash tub, fluorescent brightener contained in the detergent causes the clothes to become discolored or fade.

20 In an automatic washing machine provided with a receptacle-shaped agitator rotatably mounted on the inner bottom of the wash tub, a concave portion has recently been intended to be formed in the inner peripheral wall of the wash tub so that a space for containing the detergent is
25 defined between the wall and the receptacle-shaped agitator.

In such a construction, when the detergent is previously contained in the detergent containing space, the clothes may be prevented from being directly in contact with the detergent. When water is supplied to the wash tub upon start of the washing operation, the detergent contained in the space first dissolves in the water.

According to the above-described automatic washing machine, however, little water stream is caused in the detergent containing space even if the washing operation is started with the agitator rotated upon completion of water supply. Accordingly, since the detergent contained in the space is gradually dissolved in the wash water, it takes a lot of time for all the detergent to be dissolved in the wash water. In addition, since the wash tub takes a specific construction, the washing machines having such detergent containing space are needed to be designed and assembled on a specific assembly line different from those of the other type washing machines.

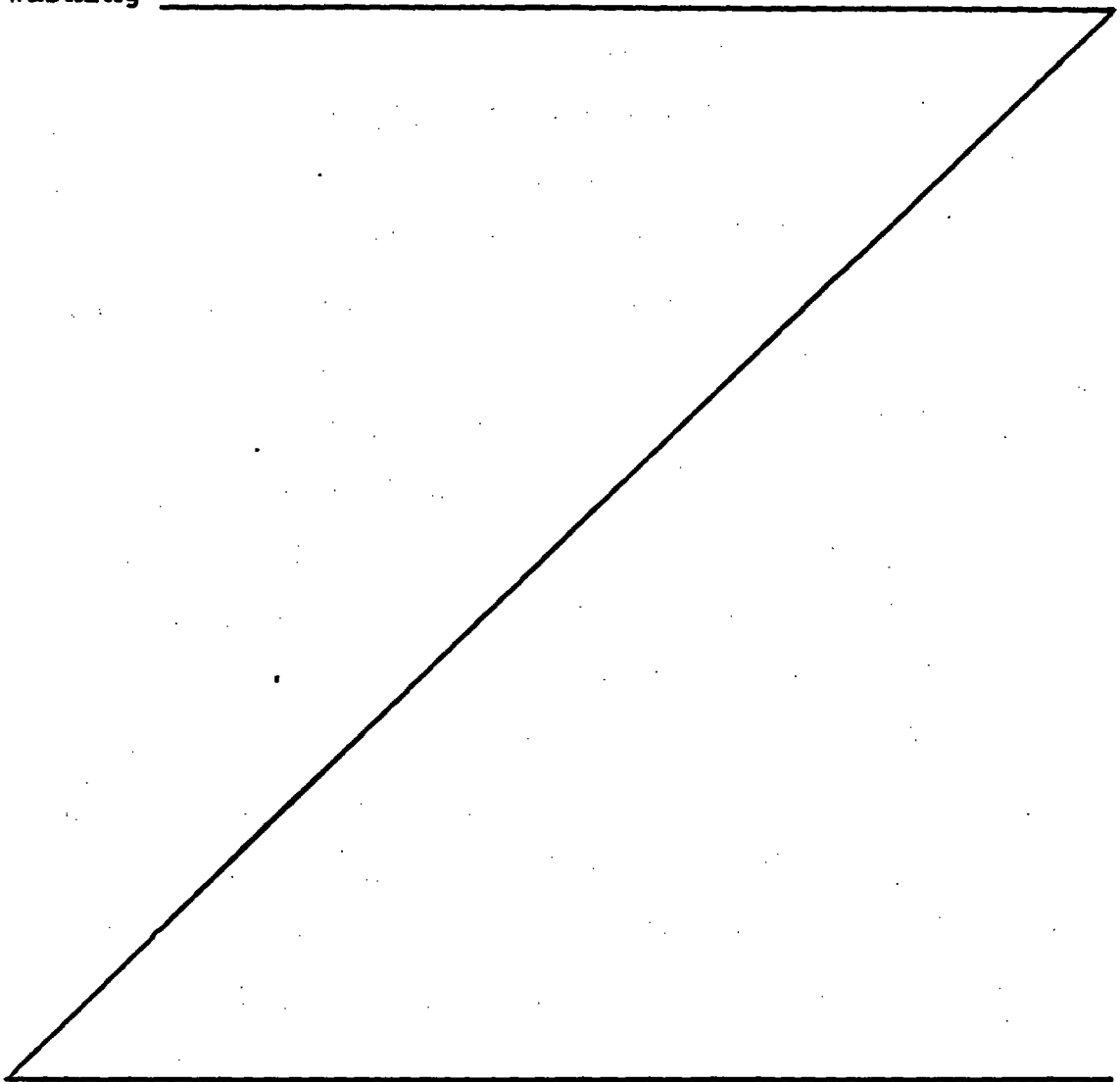
Therefore, an object of the present invention is to provide a washing machine wherein the detergent can be reserved in the wash tub without being in contact with the clothes and wherein the detergent can be quickly dissolved in water upon start of the washing operation.

According to the present invention there is provided a washing machine comprising: a) a wash tub in which wash water is contained; b) a motor for wash operation; c) an agitator provided on the inner bottom of the wash tub so as to be driven by the motor so that the agitator is rotated to cause water streams in the wash tub, the agitator being concentric with the wash tub and having a concave shape such that a peripheral wall thereof is adjacent to an inner peripheral wall of the wash tub; and d) a separator detachably mounted on the upper side of the agitator, the separator defining a detergent containing cavity at an upper area of the agitator when mounted on the upper side of the agitator, the detergent containing cavity defined by the separator being concentric with a rotational axis of the agitator and of the shape of a ring, the separator having in the central top wall thereof a water inlet through which a part of the water streams caused by rotation of the agitator passes into the cavity, the separator having in the peripheral wall thereof a water outlet through which the water in the cavity is caused to flow into the wash tub.

The detergent containing cavity may be defined so as to have a circular inner peripheral wall and concentric with the agitator about which the same is rotated. The

water inlet may be formed in the central portion of the diaphragm and the water outlet may be formed in the outer periphery of the separator.

According to the above-described washing machine, the clothes to be washed may be retained in the wash tub without being in contact with the detergent while the detergent is contained in the cavity. Upon start of the washing



operation, the detergent contained in the cavity may be dissolved in water when a part of the water streams caused by rotation of the agitator passes through the water inlet thereinto and caused to flow with the water stream
5 outwardly.

The invention will be described, merely by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view of a washing
10 machine in accordance with one embodiment of the invention;

FIG. 2 is a top plan view of an agitator employed in the washing machine;

FIG. 3 is an exploded longitudinal section of the agitator and separator to be mounted on the agitator;

15 FIG. 4 is a top plan view of the separator;

FIG. 5 is a top plan view of an operation panel employed in the washing machine; and

FIG. 6 is a longitudinal sectional view of the agitator to which the separator is attached, showing another
20 embodiment of the invention.

An embodiment wherein the invention is applied to an automatic washing machine will now be described with reference to FIGS. 1 to 5.

Referring first to FIG. 1 illustrating an overall
25 construction of the washing machine, reference numeral 1 designates an outer cabinet in which a water receiving tub 3 is resiliently suspended by a sling rod mechanism 2. A wash

tub 4 also serving as a dehydrating basket is provided in the water receiving tub 3. The wash tub 4 has a large number of dehydrating perforations (not shown) formed in the peripheral wall thereof and water passing perforations (not shown) formed in the bottom thereof so as to communicate to the water receiving tub 3. An electric motor 5 is provided in the lower interior of the outer cabinet 1. A transmission mechanism 6 provided on the underside of the water receiving tub 3 is coupled to the motor 5. A dehydration shaft 7 and a drive shaft 8 coaxial with the shaft 7 are upwardly extended through an opening (not shown) formed in the central bottom of the water receiving tub 3. The dehydration shaft 7 is then secured to the outer central bottom of the wash tub 4 and the drive shaft 8 is further extended upwardly through an opening (not shown) formed in the central bottom of the wash tub 4. An agitator 9 is secured to the upper end portion of the drive shaft 8 so as to be disposed in the lower interior of the wash tub 4. The agitator 9 will be described in detail later. The transmission mechanism 6 comprises a spring clutch mechanism and a brake mechanism for the wash tub 4 both well known in the art. During the execution of a wash step, the transmission mechanism 6 operates so that the wash tub 4 is restrained by the brake mechanism and so that rotation of the motor 5 is transmitted to the agitator 9, which is rotated alternately in the forward and reverse directions. During the execution of a dehydration step, the transmission

mechanism 6 operates so that the brake mechanism is deactivated and so that the rotation of the motor 5 is transmitted to both of the dehydration and drive shafts 7 and 8, thereby rotating the wash tub 4 and agitator 9 simultaneously in the same direction. Reference numeral 10 designates a discharge valve which is electrically energized so that wash liquid is discharged from the water receiving tub 3 or wash tub 4 to the outside through a discharge hose 11. A water supply valve (not shown) is provided in the upper interior of the outer cabinet 1 so that water is supplied to the wash tub 4. A top cover 12 is mounted on the top end of the outer cabinet 1. The upper cover 12 has an access opening (not shown) communicating with the interior of the wash tub 4 for the loading and unloading of clothes. A lid (not shown) is provided for opening and closing the access opening. An operation panel 13 as shown in FIG. 5 is provided on the upper side of the top cover 12. The operation panel 13 is provided with a operation course selecting switch 14 for selectively setting an operation course for the washing operation, time setting means comprising four push buttons for setting a desirable washing operation completion time, and display 16 for displaying the time. A control unit (not shown) comprising a microcomputer is provided in the top cover 12 for controlling the motor 5 for the execution of the wash step, water supply valve (not shown), discharge valve 10, transmission mechanism 6 and the like for automatic execution of the washing operation. The

control unit is also provided with a built-in timer means. When an operator operates the time setting means 15 so that a desirable washing operation completion time is set, the timer means starts timing the start of the washing operation which is started at the time obtained by subtracting a period necessary for the execution of the washing operation from the set washing operation completion time, thereby starting the washing operation at the washing operation starting time.

10 The agitator will now be described with reference to FIGS. 2 to 4 as well as 1. The agitator 9 is formed from, for example, a plastic material and generally into the shape of a circular shallow receptacle with an upper open end. A recessed portion 9a is formed in an annular section of the inner bottom of the agitator 9. At the center of the
15 recessed portion 9a, a boss 17 for connecting the drive shaft 8 is projected to the interior of the agitator 9. The boss 17 has an opening 17a formed in the underside thereof for insertion of the drive shaft 8 and a concave portion 17b
20 formed in the upper side thereof for insertion of a screw head. The opening 17a and concave portion 17b are communicated to each other through a screw hole. The recessed portion 9a of the agitator 9 is provided with a plurality of drain apertures 9b and three mounting bosses
25 18. Six projections 19 for the causing of water streams are extended radially vertically on a part of the inner peripheral wall of the agitator 9 positioned higher than the

recessed portion 9a. A plurality of pump-out vanes 20 for causing the water streams to recirculate are formed on the underside of the agitator 9. The agitator 9 constructed as described above is secured to the drive shaft 8 by fitting an extended end of the drive shaft 8 in the opening 17a and then by tightening a screw 21 from upward. In the condition that the agitator 9 is secured to the drive shaft 8, the peripheral wall of the agitator 9 is positioned in the vicinity of and along the lower inner peripheral wall of the wash tub 4 as if the agitator 9 constitutes the bottom of the wash tub 4.

A separator 22 is detachably mounted on the upper side of the agitator 9. The separator 22 is formed from, for example, a plastic material and tapered so as to be divergent. A peripheral flange 22a is integrally extended transversely from the lower end of the separator 22. The outer diameter of the flange 22a is smaller than the inner diameter of the recessed portion 9a of the agitator 9. Three concave portions 23 are downwardly projected on the underside of the flange 22a and have screw holes so as to correspond to the mounting bosses 18 respectively. A generally conical cap 24 is three-point supported by ribs 22b formed on the central portion of the separator 22 and provided so that the upper end thereof is positioned slightly lower than the upper open end of the separator 22. In the state that the separator 22 is mounted on the agitator 9, the conical cap 24 closes the upper concave

portion 17b of the boss 17, as will be hereinafter described. As shown in FIG. 3, the separator 22 is mounted on the agitator 9 by tightening three screws 25 (one of them shown) into the screw concave portions 23 respectively.

5 When the separator 22 is thus mounted on the agitator 9, a cavity 26 is defined between the underside of the separator 22 and the recessed portion 9a of the agitator 9, as shown in FIG. 1. Furthermore, the upper opening of the separator 22 communicating with the cavity 26 serves as both a water
10 inlet and detergent supply opening 26a and an annular gap defined by the outer periphery of the flange 22a of the separator 22 and the agitator 9 serves as a water outlet 26b communicating with the detergent containing cavity 26.

Operation of the washing machine in accordance with the
15 invention will now be described. Where an operator desires, for example, that the washing operation should be completed by utilizing the washing operation completion time presetting function when she or he gets up in the next morning, a necessary amount of detergent 27 is supplied to
20 the cavity 26 through the detergent supply opening 26a. In supply of the detergent 27 to the cavity 26, the cap 24 prevents the detergent 27 to enter the concave portion 17b of the boss 17. Clothes 28 to be washed are thereafter put into the wash tub 4. Consequently, the clothes 28 contained
25 in the wash tub 4 are separated from the detergent 27 by the separator 22. Then, the operation course selecting switch 14 on the operation panel 13 is operated for the setting of

an operation course including intensity of water stream, the number of times of rinse operation and the like and the time setting means 15 is operated so that the desirable washing operation completion time is set, thereby completing the preparation for the washing. The washing operation is automatically started at the time obtained by subtracting a period necessary for execution of the washing operation (including both wash and dehydration operations) from the set washing operation completion time. In the washing operation, a water supply step in which the water supply valve is opened to supply water to the wash tub 4 is first executed. The water supply step is completed when the water reaches a predetermined water level in the wash tub 4. Subsequently, a wash step in which the clothes are washed with the detergent is executed. The agitator 9 is alternately rotated in the forward and reverse directions during the wash step such that the projections 19 cause water streams in the wash tub 4. The water streams are caused to rise up along the inner peripheral wall of the wash tub 4, as shown by arrows in FIG. 1. Simultaneously, a part of the water streams passes through the detergent supply opening 26a into the cavity 26 and is caused to flow out of the cavity 26 through the outlet 26b. With such movement of water streams, the detergent 27 contained in the cavity 26 is agitated by the water flowing in through the detergent supply opening 26a, dissolving in the water. The detergent 27 is thus carried out of the cavity 26 into the

wash tub 4, where the detergent is promptly dissolved into the water. Consequently, the clothes 28 are washed with wash liquid containing detergent components. Upon completion of the wash step, the rinse step and wash liquid
5 discharge step are subsequently executed in sequence. Then, a dehydration operation wherein the wash tub 4 is rotated at high speed is performed, and the washing operation is completed at the set washing operation completion time.

According to the above-described embodiment, the
10 detergent 27 is contained in the cavity 26 defined by the agitator 9 and separator 22, so that the clothes 28 are separated from the detergent 27 in the wash tub 4. Consequently, even when the washing operation completion time presetting function is utilized as described above or
15 when the detergent 27 and clothes 28 are left in the wash tub 4 for a long time for some reason, the clothes 28 may be prevented from being in contact with the detergent 27 and faded or discolored. Further, upon initiation of the washing operation, the agitator 9 is rotated to thereby
20 cause the water streams which force the detergent 27 contained in the cavity 26 to rapidly flow in the circumferential direction. The detergent 27 is then carried into the water in the wash tub 4 through the outlet 26b and simultaneously, promptly agitated such that the detergent 27
25 is dissolved in the water, thereby making the most of the detergency of the detergent 27 as compared with the prior washing machine in which the detergent is gradually

dissolved in water. Further, since the cavity 26 is defined by the agitator 9 and separator 22 detachably mounted on the agitator 9, the construction of the wash tub 4 or water receiving tub 3 is not complicated. Also, it is not
5 necessary to complicate the configuration of the agitator 9. The portion for containing the detergent 27 may be cleaned with ease when the separator 22 is detached from the agitator 9. Further, since the separator 22 is mounted on the upper side of the agitator 9 so that the cavity 26 is
10 defined, it is not necessary to employ specifically constructed water receiving tub 3, wash tub 4 and agitator 9. Accordingly, the washing machine in accordance with the invention may be designed and assembled on the same assembly line as of the other type washing machines without the
15 above-described detergent containing construction.

Furthermore, since the detergent containing cavity 26 which is defined so as to have a generally circular inner peripheral wall and concentric with the agitator 9 has the water inlet or detergent supply opening 26a in the central
20 portion of the separator 22 and the water outlet 26b in the outer peripheral portion of the agitator 9, the detergent is dissolved in the water flowing in through the central water inlet 26a and radially directed. Consequently, the wash liquid containing detergent components may be uniformly
25 diffused in the wash tub 4. Further, since the conical cap 24 is integrally formed on the central portion of the separator 22 so that the mounting screw 25 of the agitator 9

is covered therewith in the condition that the separator 22 is mounted on the agitator 9, the detergent 27 may be prevented from entering grooves in the screw head and concave portion 17b. Since the boss 17 is formed on the inner central bottom of the agitator 9 so as to be projected to the interior thereof and the detergent supply opening 26a or water inlet to the cavity 26 is provided so as to be positioned over the boss 17, the detergent 27 supplied through the opening 26a is dispersed around the boss 17 in the cavity 26, whereby dissolution of the detergent into the water may be enhanced as compared with the case where all the detergent is concentrated to an area of the cavity 26.

FIG. 6 illustrates a second embodiment. The second embodiment differs from the previous embodiment in that a separator 31 is fitted to an agitator 32 not secured by way of screws. More specifically, a recessed portion 32a of the agitator 32 has a fitting aperture 32b and engagement strip 32c, and the flange 31a of the diaphragm 31 has a fitting strip 31b and an elastically deformable engagement claw 31c. The fitting strip 31b is inserted into the fitting aperture 32b and thereafter, the engagement claw 31c is engaged with the engagement strip 32c, thereby mounting the separator 31 on the agitator 32. This construction does not necessitate the agitator mounting screw and provides for simple formation of the detergent containing cavity 33.

Although the detergent containing cavity is defined by the agitator and separator in each of the foregoing

embodiments, the separator having a cavity formed beforehand may be mounted on the agitator. Although the water inlet is utilized as the detergent supply opening communicating with the detergent containing cavity, they may be separately
5 formed. In such separate formation, a lid may be provided for closing and opening the detergent supply opening.

The invention may be applied to the washing machines which are not provided with a washing operation completion time presetting function and twin tub type washing machines
10 wherein the wash tub and dehydration basket are separately disposed.

The foregoing disclosure and drawings are merely illustrative of the principles of the present invention and are not to be interpreted in a limiting sense. The only
15 limitation is to be determined from the scope of the appended claims.

**CLAIMS**

1. A washing machine comprising:
 - a) a wash tub in which wash water is contained;
 - b) a motor for wash operation;
 - c) an agitator provided on the inner bottom of the wash tub so as to be driven by the motor so that the agitator is rotated to cause water streams in the wash tub, the agitator being concentric with the wash tub and having a concave shape such that a peripheral wall thereof is adjacent to an inner peripheral wall of the wash tub; and
 - d) a separator detachably mounted on the upper side of the agitator, the separator defining a detergent containing cavity at an upper area of the agitator when mounted on the upper side of the agitator, the detergent containing cavity defined by the separator being concentric with a rotational axis of the agitator and of the shape of a ring, the separator having in the central top wall thereof a water inlet through which a part of the water streams caused by rotation of the agitator passes into the cavity, the separator having in the peripheral wall thereof a water outlet through which the water in the cavity is caused to flow into the wash tub.



2. A washing machine according to claim 1, wherein the agitator is secured to the upper end of a drive shaft driven by the motor by means of a screw and which further comprises a generally conical cap integrally formed on the inner peripheral wall of the separator so that the screw securing the agitator is covered by the conical cap from upwards when the separator is mounted on the agitator.

3. A washing machine according to claim 2, wherein the agitator has a boss formed on the central inner bottom thereof so that the boss is projected upwardly, at which boss the agitator is secured to the upper end of the drive shaft and the water inlet formed in the separator is positioned over the boss.

4. A washing machine substantially as herein described with reference to the accompanying drawings.
