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(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2005/0132758 A1****Lee et al.**(43) **Pub. Date: Jun. 23, 2005**(54) **DEVICE FOR CIRCULATING WASHING
WATER IN WASHING MACHINE**(30) **Foreign Application Priority Data**

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RESTON, VA 20191 (US)**(73) **Assignee: LG ELECTRONICS, INC., Seoul (KR)**(21) **Appl. No.: 10/928,185**(22) **Filed: Aug. 30, 2004**(57) **ABSTRACT**

A washing water circulating device in a washing machine includes a first tube connected to the tub, a water circulating pump connected to the first tube that pumps water from the tub, a second tube connected to the water circulating pump that supplies the pumped water to the tub, a bypass tube provided between the first tube and the second tube, and a control valve provided to the second tube, that guides the pumped water to one of the second tube and the bypass tube.

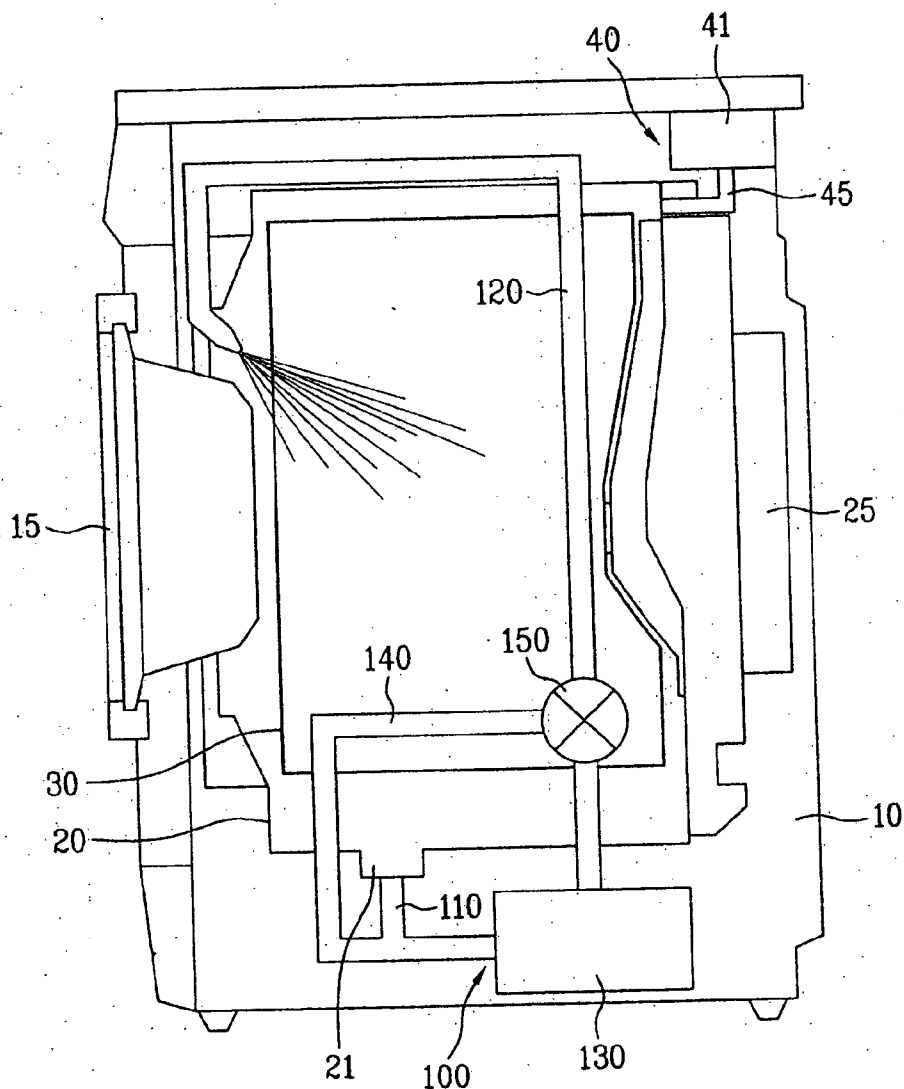


FIG. 1

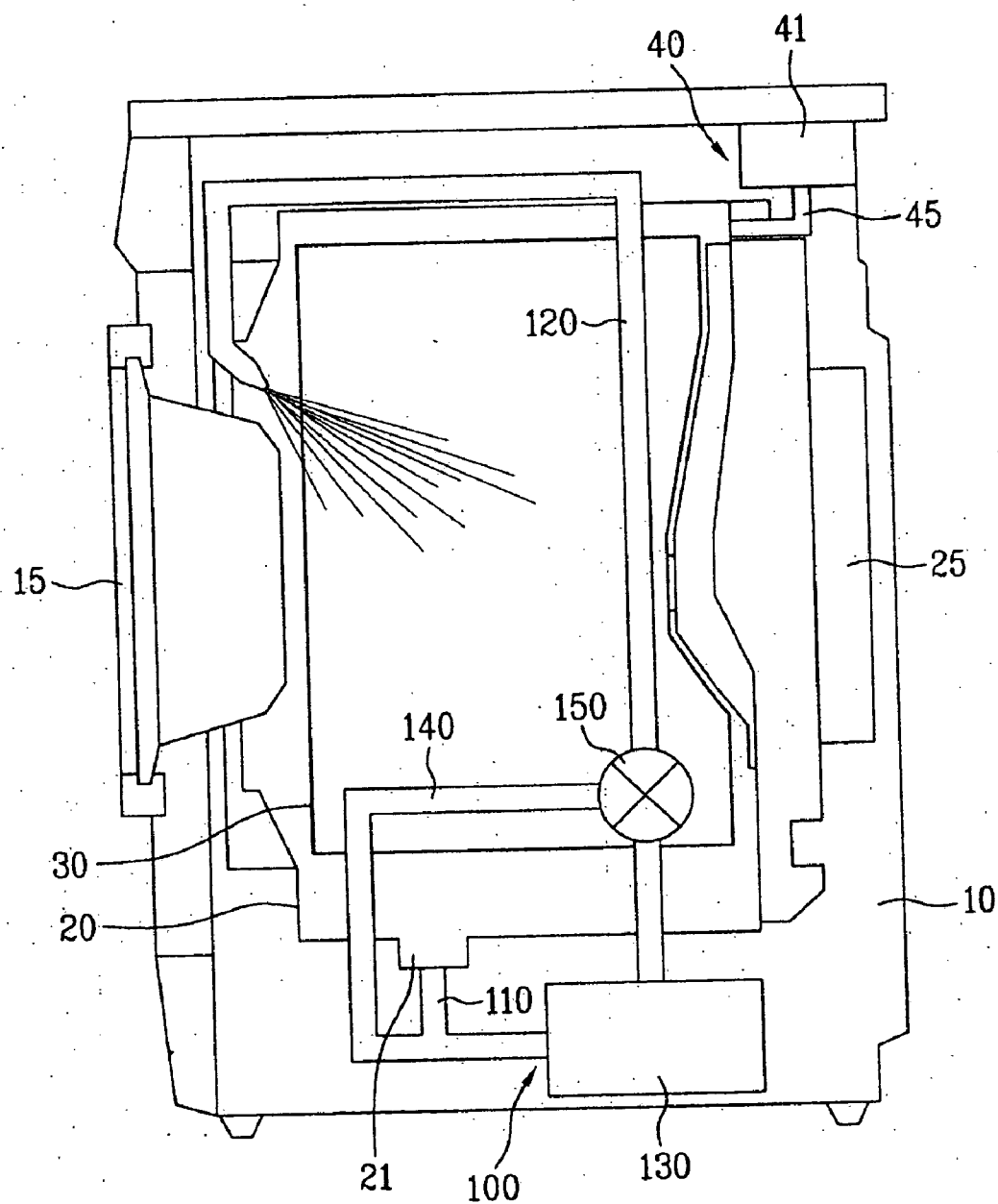


FIG. 2A

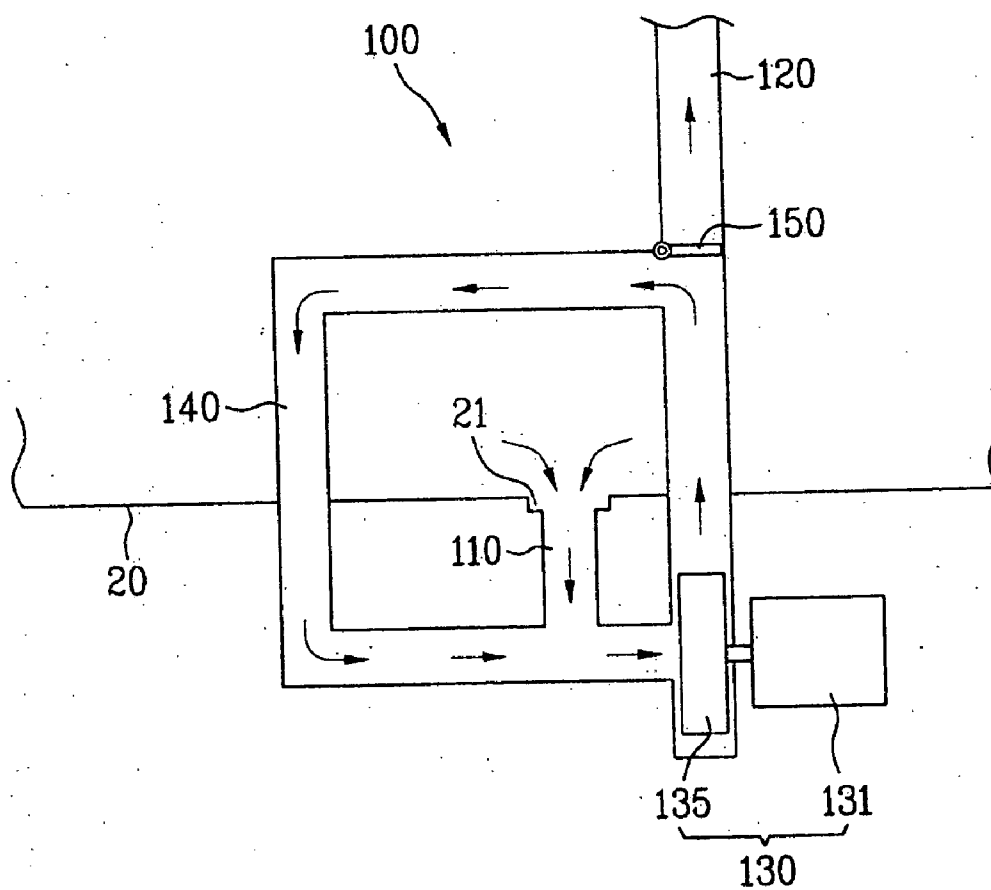
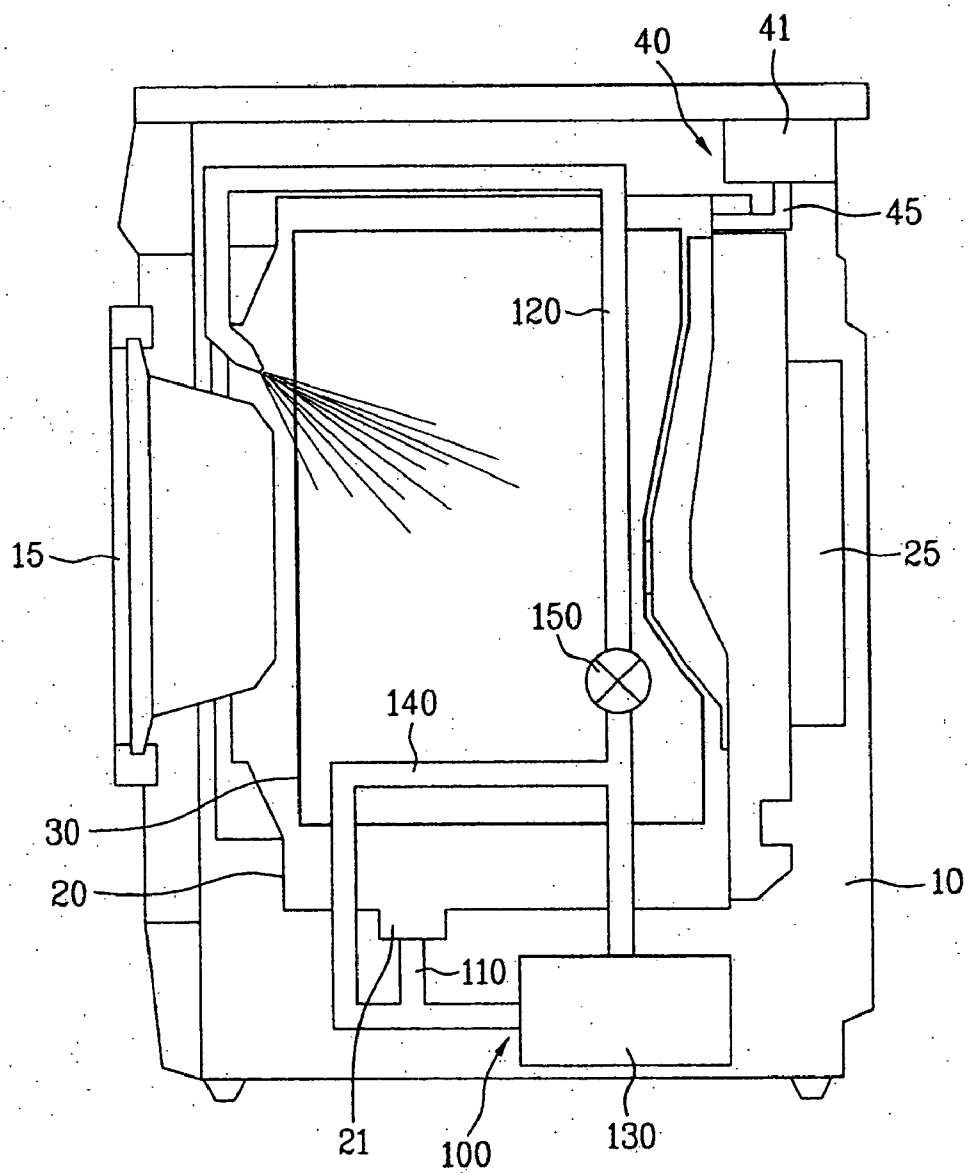


FIG. 3



DEVICE FOR CIRCULATING WASHING WATER IN WASHING MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of the Korean Application No. 10-2003-0093190 filed on Dec. 18, 2003, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to washing machines, and more particularly, to a washing water circulating device for pumping up water from a lower portion to an upper portion of a tub in a washing machine.

[0004] 2. Background of the Related Art

[0005] The washing machine removes contaminants stuck to laundry by using action of detergent and water.

[0006] In general, there are agitator type, pulsator type, and drum type washing machines. The agitator type washing machine washes by rotating a washing rod standing at a central portion of a tub in left/right directions, and the pulsator type washing machine washes laundry by using a friction force between water circulation, caused by left/right direction rotation of a disc form of pulsator on a bottom of a washing tub, and the laundry. The drum type washing machine washes laundry by putting water, detergent, and the laundry into an inside of the drum having a plurality of tumbling ribs projected from an inside surface thereof, and rotating the drum at a low speed.

[0007] In the meantime, when the laundry is washed, by using one of above different types of washing machines, detergent is used, together with water. That is, the washing is performed after the detergent is introduced into the tub having the laundry and the water filled therein, manually or automatically.

[0008] However, in case powder detergent is introduced into the tub, though a portion of the detergent is dissolved in the water and enhances a washing capability, the other portion is not dissolved and inserted between strands of the laundry. The powder detergent inserted between the strands of laundry drops washing capability of the washing machine, and prolongs a washing time period.

[0009] Moreover, even after finishing the washing, a portion of the powder detergent remains in the laundry, and damages skin of the user.

SUMMARY OF THE INVENTION

[0010] Accordingly, the present invention is directed to a washing water circulating device in a washing machine that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0011] An object of the present invention designed to solve the above problems lies in improving detergent dissolving capability of the washing machine for preventing powder detergent introduced into a tub from remaining on laundry.

[0012] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0013] To achieve these objects and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the washing water circulating device in a washing machine includes a water circulating portion that pumps water from an inside of a tub to an outside of the tub and supplies water into the tub, and a flow passage control portion that keeps the pumped water circulating through the outside of the tub, or guided into the tub.

[0014] The water circulating portion preferably includes a water circulating passage having both ends in communication with the tub, and a water circulating pump connected to the water circulating passage.

[0015] The flow passage control portion preferably includes a bypass tube having both ends connected to a water circulating passage provided for a flow of the pumped water, and a flow passage switching portion provided to the water circulating passage, that guides the pumped water to the bypass tube to circulate on the outside of the tub only, or guides the pumped water to the bypass tube and then guides the pumped water to the tub.

[0016] The flow passage control portion preferably makes the pumped water keep circulating through the outside of the tub to dissolve the detergent.

[0017] In other aspect of the present invention, there is provided a washing water circulating device in a washing machine including a first tube connected to a tub, a water circulating pump connected to the first tube that pumps water from the tub, a second tube connected to the water circulating pump that supplies the pumped water to the tub, a bypass tube provided between the first tube and the second tube, and a control valve provided to the second tube that guides the pumped water to one of the second tube and the bypass tube.

[0018] In another aspect of the present invention, there is provided a washing machine including a cabinet having a door, a tub mounted in the cabinet that holds water therein, a drum rotatably mounted in an inside of the tub, a water supplying device that supplies detergent and water to the tub, and a washing water circulating device wherein the washing water circulating device includes a first tube connected to the tub, a water circulating pump connected to the first tube that pumps water from the tub, a second tube connected to the water circulating pump that supplies the pumped water to the tub, a bypass tube provided between the first tube and the second tube, and a control valve provided to the second tube that guides the pumped water to one of the second tube and the bypass tube.

[0019] The first tube is connected to a drain, or an under side of the tub.

[0020] The second tube preferably sprays the water pumped by the water circulating pump to an inside of the drum.

[0021] The control valve is provided to a connection portion of the second tube and the bypass tube, or between the connection portion and the tub.

[0022] In the meantime, preferably the control valve guides the pumped water to the bypass tube for a preset time period at an initial stage of washing when detergent is supplied to the tub. The control valve preferably guides the water to the second tube after a preset time period set from a starting of washing is completed. The water supply device may supply detergent and water to a space between the tub and the drum.

[0023] It is to be understood that both the foregoing description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention.

[0025] In the drawings;

[0026] **FIG. 1** illustrates a diagram of a drum type washing machine having a washing water circulating device of the present invention applied thereto;

[0027] **FIG. 2A** illustrates a diagram of a position of a control valve and a water flow when the washing water circulating device of the present invention in **FIG. 1** dissolves detergent; **FIG. 2B** illustrates a diagram of a position of a control valve and a water flow when the washing water circulating device of the present invention in **FIG. 1** circulates water in a tub; and

[0028] **FIG. 3** illustrates a diagram of a modification of the drum type washing machine shown in **FIG. 1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0029] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. In describing the embodiments, identical parts will be given the same names and reference symbols, and repetitive description of which will be omitted.

[0030] **FIG. 1** illustrates a diagram of a drum type washing machine having a washing water circulating device of the present invention applied thereto. Though **FIG. 1** illustrates a drum type washing machine having a tub in a cabinet and a drum rotatably mounted on an inside of the tub, the washing machine of the present invention is not limited to the illustrated drum type washing machine, but is applicable to a pulsator type washing machine having upright tub and drum, or the like in the same fashion.

[0031] The washing machine of the present invention will be described in more detail with reference to the attached drawings. Referring to **FIG. 1**, there is an opening in a front surface of a cabinet **10** that forms an outer shape of the

washing machine, and a door **15** rotatably mounted on the front surface of the cabinet **10** for opening/closing the opening.

[0032] There is a tub **20** arranged inside of the cabinet **10** horizontal to a floor. The tub **20** is elastically supported by springs (not shown) and dampers (not shown) within the inside space. The tub **20** has an opened front surface opposite to the opening of the cabinet **10**. The tub **20** has water supplied thereto and held therein.

[0033] There is a drum **30** rotatably mounted in an inside space of the tub **20**. For this, a motor **25** is mounted on an inside of the cabinet **10** for rotating the drum **30**. **FIG. 1** illustrates an embodiment in which a shaft of the motor **25** is directly connected to the drum **30**. In this case, the shaft passes through the tub **20**. However, though not shown, the motor **25** may rotate the drum **30** indirectly. In this case, the drum **30** and the motor **25** may be connected with a belt.

[0034] The drum **30** has a plurality of pass through holes (not shown), so that water flows from the tub **20** to the inside space of the drum **30** through the pass through holes, and vice versa. Though not shown, the drum **30** has a plurality of tumbling ribs (not shown) projected from an inside circumferential surface. The tumbling ribs lift/drop the laundry when the drum **30** rotates.

[0035] In the meantime, there is a water supplying device **40** in the washing machine for supplying detergent and water into the tub **20**. The water supplying device **40** includes a water supply hose **45** connected between a water supply source, such as faucet and the tub **20**, and a detergent box **41** provided to be in communication with the water supply hose **45**.

[0036] Therefore, in a state detergent is supplied to the detergent box **41**, if water is supplied to the tub **20** through the water supply hose **45**, the detergent is supplied to the tub **20** together with water. The detergent box **41** may be designed to supply a proper amount of detergent to the water supply hose **45** or the tub **20**.

[0037] In the meantime, it is preferable that the water supply device **40** supplies the detergent and water between the tub **20** and the drum **30**, so that the water and detergent hit the drum **30**, which helps dissolve the detergent. Moreover, the powder detergent not dissolved yet flows down along an outside surface of the drum **30**, and is held on a bottom surface of the tub **20**, to prevent the powder detergent from being supplied to the laundry directly, and inserted between strands of laundry.

[0038] In the meantime, there is a drain **21** in a bottom of the tub **20**, having a drain pipe (not shown) connected thereto. The drain pipe has a drain pump (not shown) connected thereto for pumping and discharging water, introduced thereto from the tub **20** through the drain **21** and the drain pipe, to an outside of the cabinet. Of course, the drain pump has a drain hose (not shown) in communication with an outside of the washing machine. Therefore, upon putting the drain pump into operation, water is drained from the tub **20** to the outside of the cabinet **10** through the drain **21**, the drain pipe, the drain pump, and the drain hose.

[0039] In the meantime, the washing machine of the present invention further includes a washing water circulating device **100**. The washing water circulating device **100**

pumps out water from the tub 20 and the water to the tub 20 again, for improving washing and rinsing performance of the washing machine. Moreover, the washing water circulating device 100 serves most of the detergent introduced into the tub 20 to dissolve quickly. The washing water circulating device 100 will be described in more detail.

[0040] The washing water circulating device 100 includes a water circulating portion and a flow passage control portion. The water circulating portion pumps water from the tub 20 to an outside of the tub 20, and supplies the water to the tub 20 again. The flow passage control portion keeps circulating the water pumped to an outside of the tub 20 on an outside of the tub 20, or guides to the tub 20. The water circulating portion and the flow passage control portion will be described in more detail with reference to the attached drawings.

[0041] The water circulating portion includes a water circulating passage, and a circulating pump 130. The water circulating passage has both ends in communication with the tub 20, and the circulating pump 130 is connected to the circulating pump 130.

[0042] Referring to FIG. 1, the circulating passage in communication with the tub 20 includes two tubes. One is a first tube 110 connected to the drain 21 of the tub 20, or a bottom portion of the tub 20, more specifically to an underside surface thereof, and the other one is a second tube 120 in communication with an upper portion of an inside of the tub 20, substantially.

[0043] If the first tube 110 is connected to the drain 21 or the bottom portion of the tub 20, the powder detergent deposited on a bottom surface of the tub 20 can be guided to an inside of the first tube 110, easily.

[0044] In the meantime, referring to FIGS. 2A and 2B, the first tube 110 and the second tube 120 are connected to the circulating pump 130, respectively. The circulating pump 130 includes an impeller 135 for pumping water from the tub 20, and a motor 131 connected to the impeller 135 with a shaft for rotating the impeller 135.

[0045] This structure enables the water introduced into the first tube 110 by the circulating pump 130 to an inside of the tub 20 again by the second tube 120. It is preferable that the second tube 120 sprays the water pumped by the circulating pump 130 into an inside of the drum 30, to increase falling energy of the water, and to improve the washing performance and a detergent dissolving capability of the washing machine.

[0046] Next, the flow control portion includes a bypass tube 140 and a flow passage switching portion. The bypass tube 140 has both ends of the circulating passage through which the water pumped from the tub 20 flows. In more detail, one end of the bypass tube 140 is connected to the first tube 110, and the other end of the bypass tube 140 is connected to the second tube 120.

[0047] The flow passage switching portion is provided to the circulating passage, more specifically, to the second tube 120, and the water pumped from the tub 20 by the circulating pump 130, is guided to either one of the second tube 120 or the bypass tube 140.

[0048] A control valve 150 is provided at the flow passage switching portion in the present invention. As shown in FIG.

1, the control valve 150 is provided to a connection portion of the second tube 120 and the bypass tube 140, or, as shown in FIG. 3, at a point between the connection portion of the second tube 120 and the bypass tube 140 and the tub 20 of the second tube 120.

[0049] If the control valve 150 is provided to the connection portion of the second tube 120 and the bypass tube 140, the control valve 150 may be a three way valve.

[0050] In this case, as shown in FIG. 2A, the control valve 150 closes the second tube 120, and makes the bypass tube 140 and the circulating pump 130 in communication. Thus the pumped water is guided to the bypass tube 140.

[0051] The water guided to the bypass tube 140 is guided to the bypass tube 140 again after circulating through the first tube 110 and the circulating pump 130. Therefore, the water pumped by the circulating pump 130 is kept circulating on an outside of the tub 20.

[0052] On the contrary, referring to FIG. 2B, if the control valve 150 closes the bypass tube 140, and makes the circulating pump 130 and the tub 20 in communication, the water pumped by the circulating pump 130 is guided to the tub 20 via the second tube 120.

[0053] In the meantime, as shown in FIG. 3 if the control valve 150 is provided between the tub 20 and the connection portion of the second tube 120 and the bypass tube 140, an on/off valve is used for the control valve 150.

[0054] In this case, if the control valve 150 closes, the water pumped by the circulating pump 130 can not pass through the second tube 120, but is guided to the bypass tube 140. The water guided to the bypass tube 140 is guided to the bypass tube 140 again through the first tube 110 and the circulating pump 130. Therefore, the water pumped by the circulating pump 130 is kept circulating on an outside of the tub 20.

[0055] On the contrary, if the control valve 150 is opened, as shown in FIG. 2B, the water pumped by the circulating pump 130 passes through the second tube 120, and is supplied to the tub 20.

[0056] Thus, the washing water circulating device 100 of the present invention having the flow passage control portion either circulates the water pumped to an outside of the tub 20 only on an outside of the tub 20, or is supplied to the tub, again.

[0057] Thus, because water from the tub 20 is circulated, most of the powder detergent introduced into the tub 20 can be dissolved within a short time period at an initial stage of the washing. That is, when the detergent is introduced into the tub 20, if the water and detergent are kept circulating on an outside of the tub 20 after the water and detergent are pumped to the outside of the tub 20, a large amount of the detergent is dissolved quickly by the impeller 135 and the friction force caused by water circulation.

[0058] Therefore, if the water is supplied from the washing water circulating device 100 to the tub 20 after the detergent is dissolved, not only the insertion of powder detergent between strands of the laundry, but also a washing time period can be reduced, and a washing capability can be improved.

[0059] A time period in which the washing water circulates in the washing water circulating device 100 is preset at a control portion in the washing machine. In this instance, the control portion may control the time period for circulating the water and the detergent on the outside of the tub 20 for dissolving the detergent according to an amount of the laundry and an amount of the detergent.

[0060] Also, the control portion may preset a time period for circulating the water and the detergent on the outside of the tub 20 for dissolving the detergent regardless of an amount of the laundry and an amount of the detergent.

[0061] Moreover, the control portion may control to repeat circulating the water and detergent on the outside of the tub 20 for a preset time period, and supplying into the tub 20.

[0062] The operation of the washing machine having the washing machine circulating device 100 of the present invention will be described.

[0063] The door is opened, and the laundry is introduced into the drum 30. The door 15 is closed, and the washing machine is put into operation to introduce external water into the detergent box 41 through the water supply hose 45. The detergent in the detergent box 41 dissolves in the water supplied thereto, and the water having the detergent dissolved therein is supplied between the tub 20 and the drum 30 through the water supply hose 45.

[0064] The water and detergent supplied between the tub 20 and the drum 30 slides along an outside circumferential surface of the drum 30, and held on the bottom surface of the tub 20. According to this, the direct contact of the detergent not yet dissolved with the laundry and insertion between the strands of the laundry can be prevented effectively.

[0065] At the initial stage of the washing when the water and detergent are supplied to the tub 20, the water circulating pump 130 is operated. In this instance, as shown in FIG. 2A, the control valve 150 guides the water passed through the first tube 110 and the circulating pump 130, to the bypass tube 140.

[0066] According to this, the water and detergent pumped from the tub 20 to the outside of the tub 20 by the circulating pump 130 circulates on the outside of the tub 20 for a preset time period, to dissolve the most of the detergent. In the meantime, at the initial stage of washing in which the water and detergent are supplied to the tub 20, and the detergent is dissolved in the water, the drum 30 is rotated at a lower speed or stationary.

[0067] After a preset time is passed from the starting of the washing, as shown in FIG. 2B, the water is guided to the tub 20 via the second tube 120. Then, the water having the detergent dissolved therein passes through the second tube 120, and is supplied to the tub 20.

[0068] In the meantime, if a certain amount of water is supplied to the tub 20, the motor 25 rotates the drum 30. When the drum 30 rotates, the laundry is lifted by the tumbling ribs, and dropped. Therefore, by chemical reaction of the detergent, impact energy when the laundry drops by the tumbling ribs, and the water circulation occurred at the time of rotation of the drum 30, contaminants are separated from the laundry, to perform the washing.

[0069] During the washing, the washing water circulating device 100 pumps water from the tub 20 and sprays into the

tub 20 again. Friction and impact energy generated by the falling water when the water is sprayed into the tub 20 improves a washing capability of the washing machine.

[0070] After washing is performed for a preset time period by rotating the drum 30, the drum 30 and the circulating pump 130 stop. Contaminated water from the washing is drained to an outside of the washing machine. During the draining the drain pump (not shown) is put into operation to discharge the contaminated water from the tub 20 to the outside of the washing machine through the drain hose (not shown).

[0071] After draining is finished, the drain pump stops, and water is supplied to the tub 20 newly through the water supply hose 45, and the drum 30 rotates to carry out a rinsing process. During rinsing, as the drum 30 rotates, and the circulating pump 130 operates, the rinsing is carried out by a process similar to the washing process.

[0072] The laundry, washing of which is finished as the rinsing and drain are repeated, has its water extracted within a drum that spins at a high speed. If the washing machine is provided with a heater or blower, the laundry having water extracted therefrom is dried completely by using hot air.

[0073] Thus, the washing water circulating device of the present invention can dissolved most of detergent by keeping circulating the detergent and the water on an outside of the tub.

[0074] The supply of the water and the detergent from the detergent box to a space between the drum and the tub can prevent the powder detergent inserted between strands of the laundry.

[0075] Therefore, even after the washing is finished, it is possible to prevent the powder detergent remaining on the laundry even after finish of the washing, as well as damage to skin of the user due to the remained detergent.

[0076] Because the washing water circulating device makes the most of the detergent to be dissolved, washing capability of the washing machine is improved, and the washing time period is shortened. Particularly, a rinsing time period required for removing the detergent from the laundry can be shortened.

[0077] Moreover, the system is very simple, a performance of the washing machine can be improved at a low cost.

[0078] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A washing water circulating device in a washing machine comprising:

a water circulating portion that pumps water from an inside of a tub to an outside of the tub and supplies water into the tub; and

a flow passage control portion that keeps the pumped water circulating through the outside of the tub, or guides the pumped water into the tub.

2. The device as claimed in claim 1, wherein the water circulating portion comprises;

a water circulating passage having both ends in communication with the tub, and

a water circulating pump connected to the water circulating passage.

3. The device as claimed in claim 1, wherein the flow passage control portion comprises;

a bypass tube having both ends connected to a water circulating passage provided for a flow of the pumped water, and

a flow passage switching portion provided to the water circulating passage, the flow passage switching position guiding the pumped water to the bypass tube to circulate through the outside of the tub only or guiding the pumped water to the bypass tube and then guiding the pumped water to the tub.

4. The device as claimed in claim 1, wherein the flow passage control portion makes the pumped water keep circulating through the outside of the tub, to dissolve detergent.

5. A washing water circulating device in a washing machine comprising:

a first tube connected to a tub;

a water circulating pump connected to the first tube, the water circulating pump pumping water from the tub;

a second tube connected to the water circulating pump, the second tube supplying the pumped water to the tub;

a bypass tube provided between the first tube and the second tube; and

a control valve provided to the second tube, the control valve guiding the pumped water to one of the tub and the bypass tube.

6. The device as claimed in claim 5, wherein the first tube is connected to a drain.

7. The device as claimed in claim 5, wherein the first tube is connected to an under side of the tub.

8. The device as claimed in claim 5, wherein the control valve is provided to a connection portion of the second tube and the bypass tube.

9. The device as claimed in claim 5, wherein the control valve is provided between a connection portion of the second tube and the bypass tube.

10. The device as claimed in claim 5, wherein the control valve guides the pumped water to the bypass tube for a preset time period at an initial stage of washing when detergent is supplied to the tub.

11. The device as claimed in claim 5, wherein the control valve guides the pumped water to the tub after a preset time period set from a starting of washing is over.

12. A washing machine comprising:

a cabinet having a door;

a tub mounted in the cabinet, the tub configured to hold water therein;

a drum rotatably mounted in an inside of the tub;

a water supplying device that supplies detergent and water to the tub; and

a washing water circulating device, wherein the washing water circulating device comprises: a first tube connected to the tub; a water circulating pump connected to the first tube, the water circulating pump pumping water from the tub; a second tube connected to the water circulating pump, the second tube supplying the pumped water to the tub; a bypass tube provided between the first tube and the second tube; and a control valve provided to the second tube, the control valve guiding the pumped water to one of the second tube and the bypass tube.

13. The washing machine as claimed in claim 12, wherein the first tube is connected to a drain.

14. The washing machine as claimed in claim 12, wherein the first tube is connected to an under side of the tub.

15. The washing machine as claimed in claim 12, wherein the second tube sprays the pumped water to an inside of the drum.

16. The washing machine as claimed in claim 12, wherein the control valve is provided to a connection portion of the second tube and the bypass tube.

17. The washing machine as claimed in claim 12, wherein the control valve is provided between a connection portion of the second tube and the bypass tube and the tub.

18. The washing machine as claimed in claim 12, wherein the control valve guides the pumped water to the bypass tube for a preset time period at an initial stage of washing when detergent is supplied to the tub.

19. The washing machine as claimed in claim 12, wherein the control valve guides the pumped water to the tub after a preset time period set from a starting of washing is completed.

20. The device as claimed in claim 10, wherein the preset time period is determined based on an amount of laundry and an amount of detergent.

21. The device as claimed in claim 11, wherein the preset time period is determined based on an amount of laundry and an amount of detergent.

22. The device as claimed in claim 10, wherein the preset time period is set regardless of an amount of laundry and an amount of detergent.

23. The device as claimed in claim 11, wherein the preset time period is set regardless of an amount of laundry and an amount of detergent.

24. The device as claimed in claim 18, wherein the preset time period is determined based on an amount of laundry and an amount of detergent.

25. The device as claimed in claim 19, wherein the preset time period is determined based on an amount of laundry and an amount of detergent.

26. The device as claimed in claim 18, wherein the preset time period is set regardless of an amount of laundry and an amount of detergent.

27. The device as claimed in claim 19, wherein the preset time period is set regardless of an amount of laundry and an amount of detergent.

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