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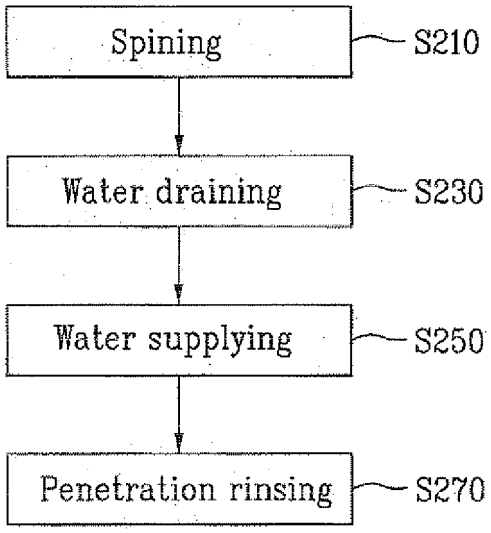
(54) **Controlling method of washing machine**

(57) A controlling method of a washing machine is disclosed. A controlling method of a washing machine includes spinning to rotate a drum at a first speed to dehydrate the laundry, water draining to drain water from the drum, water supplying to supply water to a tub, while rotating the drum at a second speed for the laundry to be closely in contact with an inner circumferential surface of the drum, and penetration rinsing while rotating the drum at the second speed or at a third speed to rinse the laundry. According to the controlling method, a time taken to perform a rinsing cycle may be reduced. Furthermore, rinsing efficiency may be improved together with the reduced time of the rinsing cycle.

FIG. 2



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Description

[0001] This application claims the benefit of Patent Korean Application No. 10-2008-0034175, filed on April 14, 2008, which is hereby incorporated by reference as if fully set forth herein.

[0002] The present invention relates to a controlling method of a washing machine. More particularly, the present invention relates to a controlling method of a washing machine to reduce an overall washing time with an improved rinsing efficiency.

[0003] Washing machines are home electric appliances that remove dirt from washing objects including clothes, cloth items, beddings and the like (hereinafter, laundry) through a washing, rinsing and spinning cycle. Such washing machines may be categorized, based on how to load laundry, into top loading types and front loading types. The top loading type washing machines may be categorized into drum types and pulsator types. In a drum type, a drum is rotated during the washing and rinsing cycle. In a pulsator type, a pulsator is provided in a tub and the pulsator is rotated.

[0004] The front loading type and the top loading type drum washing machine include a cabinet, a tub and a drum. The cabinet defines an exterior appearance of the washing machine. The tub is provided in the cabinet and it holds wash liquid. The drum is rotatable and it is provided in the tub. Laundry is held in the drum. As the drum or pulsator is rotated horizontally or vertically, the washing, rinsing and spinning cycle may be performed.

[0005] However, if the drum is rotated at a relatively high speed with the laundry loaded in the drum, the laundry might be collected in a side of the drum. As a result, a large vibration might be generated and a predetermined process is necessary to spread the laundry inside the drum uniformly. The process is especially necessary in the rinsing cycle because water should be supplied repeatedly to remove detergent in the rinsing cycle.

[0006] Accordingly, it takes a substantially long time to spread the laundry uniformly in an overall washing course of a conventional washing machine, especially, in the rinsing cycle of the washing course.

[0007] Accordingly, the present invention is directed to a controlling method of a washing machine.

[0008] In one aspect, a controlling method is provided to reduce a time of a rinsing cycle.

[0009] In another aspect, a controlling method of a washing machine is provided to improve rinsing efficiency as well as to reduce the time of the rinsing cycle.

[0010] Additional advantages, objects, and features of the disclosure will be set forth in part in the description which follows and in part will become 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 may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0011] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a controlling method of a washing machine may include spinning to rotate a drum at a first speed to extract water from the laundry; water draining to drain water from the drum; water supplying to supply water to a tub, while rotating the drum at a second speed for the laundry to be closely in contact with an inner circumferential surface of the drum; and penetration rinsing while rotating the drum at a third speed to rinse the laundry.

[0012] In the spinning operation, the first speed may be more than 600 rpm to dehydrate, i.e., drain water from, the laundry.

[0013] In the water draining operation, the rotation speed of the drum may be reduced. Especially, it is preferable that in the water draining operation, the rotation speed of the drum is reduced to a predetermined speed that is higher than a minimum drum speed at which the laundry is closely in contact with the inner circumferential surface of the drum.

[0014] In the water supplying operation, the second speed may be higher than a minimum drum speed at which the laundry is closely in contact with the inner circumferential surface of the drum. It is preferable that in the water supplying operation, water is supplied to a predetermined depth lower than a distance between the tub and the drum.

[0015] In the penetration rinsing operation, water held in the tub may be circulated during the rotation of the drum. Here, in the penetration rinsing operation, the circulated water may be supplied in at least one of a horizontal direction and a vertical direction along an inside of the drum.

[0016] The third speed may be lower than the first speed and higher than the second speed. Specifically, in the penetration rinsing operation, the drum may be rotated at the third speed such that the circulated water is penetrated through the laundry that is closely in contact with the inner circumferential surface of the drum to perform rinsing.

[0017] The controlling method may further include at least one tumbling rinsing operation after the spinning operation the water draining operation, the water supplying operation, and the penetration rinsing operation are performed repeatedly a plurality of times.

[0018] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

[0019] The accompanying drawings, which are included to provide a further understanding of the disclosure and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the disclosure and together with the description serve to explain the principle of the disclosure. In the drawings:

[0020] FIG. 1 is a perspective view illustrating a wash-

ing machine having a controlling method of an exemplary embodiment applied thereto;

[0021] FIG. 2 is a flow chart of the controlling method;

[0022] FIG. 3 is a graph illustrating a rotation speed of a drum of a washing machine according to an exemplary embodiment;

[0023] FIG. 4 is a graph illustrating a rotation speed of a drum of a washing machine according to another embodiment; and

[0024] FIG. 5 is a perspective view illustrating a nozzle to supply wash water circulated in FIG. 1.

[0025] Reference will now be made in detail to the specific embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0026] A washing machine having a controlling method according to an exemplary embodiment applied thereto will be explained first and the controlling method will be explained next.

[0027] FIG. 1 is a perspective view illustrating a washing machine to which a controlling method according to an exemplary embodiment is applied. FIG. 1 shows a front loading type washing machine. However, the controlling method according to the embodiment can be applied to a top loading type drum washing machine as well as the front loading type drum washing machine. The embodiment will be explained with reference to the front loading type drum washing machine.

[0028] In reference to FIG. 1, the washing machine includes a cabinet 10, a tub (not shown) and a drum 20. The cabinet 10 defines an exterior appearance of the washing machine. The tub (not shown) is provided in the cabinet 10 and the drum 20 is rotatably provided in the tub.

[0029] Wash water is held in the tub and laundry may be loaded through a door 12 coupled to a front of the cabinet 10. The drum 20 may be rotated by driving means (not shown) including a motor. As the drum 20 is rotated, a washing, rinsing and spinning cycle may be performed.

[0030] An operational part 14 may be provided on a front surface of the cabinet 10 to control an operation of the washing machine and to display a state of the washing machine. Because of the operational part 14, a user can control the operation of the washing machine and recognize a state of the washing machine.

[0031] The washing machine may be configured to provide a washing course including a washing and rinsing and spinning cycle. A washing machine having a drying function may be further configured to provide a drying course. In the washing cycle, water is primarily supplied to the drum 20 and the drum 20 is rotated in a clockwise and counter-clockwise direction to perform washing. In the rinsing cycle, the laundry is dehydrated and the drum 20 is rotated to rinse the laundry. In the spinning cycle, the drum 20 is rotated at a high speed and the laundry is spun to dehydrate the laundry.

[0032] In the rinsing cycle, water is again supplied and the drum 20 is rotated to remove detergent from the laundry. This results in taking quite a long time. That is, in the conventional washing machine, during the water supply operation, the drum 20 stops rotating and the laundry may drop to a lower portion of the drum.

[0033] Hence, if the drum 20 is re-rotated after the water supply, laundry may not be spread uniformly in the drum 20 and thus a process of spreading the laundry should additionally be performed. For example, the drum 20 is repeatedly rotated in a clockwise direction and counter-clockwise direction at a predetermined speed to uniformly spread the laundry in the drum 20. After that, the drum 20 is re-rotated to perform a rinsing cycle. As a result, a lot of time is required for a rinsing cycle, because the process of spreading laundry should be performed every time in the water supply operation of the rinsing cycle. This can be quite inconvenient to a user.

[0034] The controlling method of a washing machine according to the embodiment tries to solve that and it is developed to improve rinsing efficiency. Next, the controlling method of an exemplary embodiment will be explained with reference to the drawings.

[0035] FIG. 2 is a flow chart of the controlling method according to an exemplary embodiment and FIG. 3 is a graph illustrating a rotation speed of the drum 20 in the controlling method.

[0036] With reference to FIGS. 2 and 3, the controlling method of the embodiment relates to a rinsing cycle that may be included in a washing course of a washing machine or a rinsing cycle that may be performed independently from other cycles.

[0037] The controlling method includes spinning (S210), water draining (S230), water supplying (S250) and rinsing (S270). In the spinning step (S210), the laundry is spun to dehydrate the laundry. In the water draining step (S230), water of the drum 20 is drained. In the water supplying step (S250), water is supplied to the tub, and the drum 20 is rotated so that the laundry is not spaced apart from an inner circumferential surface of the drum 20, in other words, for the laundry to be closely in contact with an inner circumferential surface of the drum 20. In the penetration rinsing step (S270), the laundry is rinsed. That is, in the controlling method of the embodiment, the drum 20 is rotated in a case where water is supplied to the tub. Especially, the drum 20 is rotated at a predetermined speed higher than a minimum drum speed at which the laundry is not spaced apart from the inner circumferential surface of the drum 20. As a result, a process of spreading the laundry uniformly may not be needed after the water supply operation.

[0038] First of all, according to the controlling method of the embodiment, the drum 20 is rotated at a first speed to dehydrate the laundry (S210). Commonly, the rinsing cycle is performed after the washing cycle and it is preferable that the laundry is dehydrated prior to the rinsing cycle.

[0039] In this spinning step (S210), the drum 20 is ro-

tated at the first speed to dehydrate the laundry. The first speed may be adjustable according to a capacity of the washing machine and an amount of the laundry. For example, the first speed may be approximately 600 rpm. In the spinning step of the controlling method according to the embodiment, the drum 20 is rotated at the first speed, for example, more than 600 rpm to dehydrate the laundry.

[0040] More specifically, in the spinning step as shown in FIG. 3, the rotation speed of the drum 20 is increased until the first speed is reached. Hence, if the rotation speed of the drum 20 reaches the first speed, the rotation speed may be reduced immediately and it is preferable that the rotation speed of the drum 20 is maintained at the first speed during a predetermined time period, for example, 2 to 5 seconds. Maintaining the rotation speed of the drum 20 at the first speed makes it possible to dehydrate the laundry easily.

[0041] After dehydrating the laundry, water in the tub 10 may be drained (S230). The removed moisture of the laundry in the spinning step is stored in the tub and thus it is necessary to drain the water held in the tub.

[0042] As shown in FIG. 3, the water of the tub is drained and it is preferable that the water in the tub is drained as the rotation speed of the drum 20 is reduced. If the drum 20 is rotated at a relatively high speed, the water of the tub may not be drained because of the high speed rotation of the drum 20. As a result, if the water is drained as the rotation speed of the drum 20 is reduced, it is possible to easily drain the water in the tub.

[0043] Although the rotation speed of the drum 20 is reduced in the water draining step, it is preferable that the laundry is closely in contact with the inner circumferential surface of the drum 20. That is, if the laundry is spaced apart and dropped from the inner circumferential surface of the drum 20, a process of spreading the laundry in the drum 20 uniformly should be performed after the water supplying step which will be described later and an overall time of the rinsing cycle is increased accordingly.

[0044] Thus, in the water draining step according to the controlling method of the embodiment, the rotation speed of the drum 20 is reduced until a predetermined speed higher than the minimum drum speed at which the laundry is closely in contact with the inner circumferential surface of the drum 20. This minimum drum speed may be adjustable according to a capacity of a washing machine, a capacity of a drum and an amount of loaded laundry. In this embodiment, it is not limited to a specific number, but the minimum drum speed of this embodiment may be, for example, approximately 100 to 110 rpm.

[0045] In other words, the rotation speed of the drum 20 is reduced until a predetermined speed higher than the minimum drum speed, for example, 100~110 rpm, during the water draining operation of the tub.

[0046] According to the embodiment of the controlling method, water is supplied to the tub after the water draining step. Specifically, the water is supplied to the tub while rotating the drum 20 at a second speed so that the laundry is not spaced apart from the inner circumferential surface of the drum 20 (S250).

[0047] That is, after the water of the tub is drained, water is supplied to the tub to rinse the laundry. In this case, according to the embodiment of the controlling method, the drum 20 is not stopped, but instead is rotated at the second speed during the water supplying operation. It is preferable that the drum 20 is rotated at a predetermined speed higher than the minimum drum speed at which the laundry is closely in contact with the inner circumferential surface of the drum 20, in other words, the laundry is not spaced apart from the inner circumferential surface of the drum 20.

[0048] As mentioned above, in order not to perform an additional process of spreading the laundry in the drum 20 uniformly, also in the water supplying step, the water is supplied as the drum 20 is rotated at a predetermined speed higher than the minimum drum speed at which the laundry is not spaced apart from the inner circumferential surface of the drum 20 after the water supplying step. The minimum drum speed may be, for example, 100 ~ 110 rpm, which is a relatively low speed, but is enough to perform the water supplying step smoothly. At this time, the drum 20 is repeatedly rotated and the laundry is closely in contact with the inner circumferential surface of the drum 20 by centrifugal force. As a result, the rinsing process may start immediately without performing an additional process of spreading the laundry uniformly in the drum 20 after the water supplying step.

[0049] In the water supplying step of the embodiment, in case of supplying water, the water may be supplied to a level lower than a distance between the tub and the drum 20. That is, if the water is supplied to the tub, a level of the water held in the tub may not be increased over the drum 20 and it is preferable that the level of the water held in the tub may not reach the drum 20.

[0050] As mentioned above, the drum 20 is rotated during the water supplying step. If the level of the water is over the drum 20, the rotation of the drum 20 may not be performed smoothly because of the friction between the drum 20 and the water. In addition, if the controlling method according to the embodiment includes the penetration rinsing step, the drum 20 is rotated at a relatively high speed. As a result, it is preferable that the water is supplied to the level high enough not to reach the drum 20 in order to avoid the friction between the drum 20 rotating at the high speed.

[0051] According to the controlling method of the embodiment, after the water supplying step, the drum 20 is rotated at the second speed like in the water supplying step to perform rinsing (S270).

[0052] Specifically, according to an embodiment, the rinsing (S270) is performed by rotating the drum 20 at the same rotation speed as the speed of the water supplying step, namely, the second speed.

[0053] Specifically, the second rotation speed of the water supplying step is higher than the minimum drum speed at which the laundry is not spaced apart from the

inner circumferential surface of the drum 20. Thus, if the drum 20 is rotated repeatedly at the second speed, the laundry may not be spaced apart from the inner circumferential surface of the drum 20 during both the water supplying step and the rinsing step. As a result, it is possible to reduce the rinsing time remarkably. Thus, in this embodiment, the water supplying step is performed while rotating the drum 20 at the second rotation speed. After the water supplying step, the rinsing step starts.

[0054] Here, when the rinsing step (S270) is performed in this embodiment, 'penetration rinsing' may be performed with rotating the drum at the second speed. The term 'penetration rinsing' means that rinsing is performed while rotating the drum 20 at a speed at which the laundry is in close contact with the inner circumferential surface of the drum 20, different from the conventional rotation speed of the rinsing. In this case, the water of the laundry is penetrated through the laundry by centrifugal force and it is discharged out of the drum 20 to perform rinsing.

[0055] This penetration rinsing step is performed by rotating the drum 20, with the water held in a lower portion of the tub being circulated to an upper portion of the tub. If the water level may not reach the drum 20 during the water supplying as mentioned above, an amount of the water may be insufficient during the penetration rinsing step. As a result, the water held in the lower portion of the tub is circulated to the upper portion and the water is re-supplied to the drum 20 in the penetration rinsing step. As a result, the rinsing may be performed more smoothly.

[0056] Although not shown in the drawings, the washing machine having the controlling method applied thereto may include a circulation unit configured to circulate wash water. The circulation unit may include a circulation line and a circulation pump. The lower portion of the tub is connected with the upper portion of the tub by the circulation line. The circulation pump is configured to circulate the wash water to the upper portion of the tub along the circulation line. Thus, it is possible to supply the water held in the lower portion of the tub to the inside of the drum 20 again via the upper portion of the tub along the circulation line by using the circulation pump. In this case, a nozzle may be provided at an end of the circulation line connected with the upper portion of the tub to spray the water. The nozzle to supply the circulated wash water may be provided in the upper portion of the tub, preferably, in an upper front portion of the tub.

[0057] In this case of supplying the wash water via the nozzle, the nozzle is provided at the upper front portion of the tub and the wash water might be supplied mainly to a front portion of the drum 20. Especially, the wash water sprayed via the nozzle at a predetermined water pressure may be supplied to the front portion of the drum 20 in a horizontal direction. This might cause a problem that the wash water is supplied only to some of the laundry put in the front portion of the drum 20 and not to the other laundry put in a rear portion of the drum 20.

[0058] Thus, it is preferable that the wash water is supplied in at least one of a horizontal direction and a vertical direction along the inside of the drum 20 when the wash water is circulated in the rinsing step.

[0059] Then, it is possible to supply the wash water in a horizontal direction along the inside of the drum 20 by using the conventional nozzle. To supply the wash water along a vertical direction of the inside of the drum, an auxiliary configuration is necessary to supply the wash water to plural spots along a vertical direction inside the drum 20.

[0060] FIG. 5 is a perspective view illustrating a circulation nozzle configured to supply the wash water along a vertical direction of the drum inside of the washing machine.

[0061] In reference to FIG. 5, the circulation nozzle 100 may be formed to spray the wash water to a rear portion as well as a front portion of the drum 20 along a vertical direction. The circulation nozzle 100 may be formed to spray the wash water along plural directions of the drum interior so that the wash water may be uniformly supplied to the laundry in the drum 20.

[0062] As a result, the circulation nozzle 100 may include plural spray holes 110 directed toward the drum interior. Each of the spray holes 110 may be formed to spray the wash water to a different drop position along a vertical direction of the drum 20. That is, the spray holes 110 may be configured to spray the wash water to different positions spaced apart a predetermined distance from the front portion to the rear portion of the drum 20, respectively. As a result, the wash water is uniformly supplied to the laundry inside the drum 20 regardless of the rotation of the drum 20.

[0063] On the other hand, the circulation nozzle 100 may be installed at a front portion of the drum 20 where an opening of the drum 20 is formed. In this case, it is preferable that a spraying direction or spraying speed of the wash water sprayed through each of the spray holes 110 may be different from each other so that the wash water may be sprayed to different positions from the front portion to the rear portion of the drum 20 via the spray holes 110, respectively. At this time, it is preferable that each of the spray holes 100 formed at the circulation nozzle 100 includes different cross sections or different paths, respectively.

[0064] Specifically, a cross section of each spray hole 110 of the circulation nozzle 100 is different from each other to make the pressure of the wash water sprayed via each of the spray holes 110 different from each other. Here, as the cross section of the spray hole 110 is smaller, the pressure of the wash water is higher and as the cross section is larger, the pressure of the wash water is lower. As a result, the wash water sprayed via the spray hole 110 having a larger cross section at a lower pressure is dropped immediately, whereas the wash water sprayed via the spray hole 110 having a smaller cross section at a higher pressure is sprayed further in a spraying direction.

[0065] The spray hole 110 having the larger cross section may be formed to supply the wash water to the front

portion of the drum 20 and the spray hole 110 having the smaller cross section may be formed to supply the wash water to the rear portion of the drum 20.

[0066] Specifically, the spray holes 110 formed along direction 'a' may have a relatively smaller cross sections, and the spray holes 110 formed along direction 'b' may have a relatively larger cross sections. As a result, the wash water may be sprayed at a relatively higher pressure via the spray holes 110 formed along direction 'a' and the wash water may be sprayed at a relatively lower pressure via the spray holes 110 formed along direction 'b'.

[0067] Furthermore, the spray holes 110 of the circulation nozzle 100 may be connected with paths 120 formed differently from each other, respectively. It may be possible to differentiate a speed of the wash water sprayed via each of the spray holes 110 of the circulation nozzle 100.

[0068] That is, the circulation nozzle 100 may include plural paths 120 and the wash water drawn from the circulation unit 40 passes through the paths 120. Each of the paths 120 may be formed corresponding to each of the plural spray holes 110 such that the wash water having passed through each of the paths 120 may be sprayed with a different speed.

[0069] For example, the wash water having passed through the path 120 formed in a vertical direction is dropped in the front portion of the drum 20, and the wash water having passed through the path 120 extended in a horizontal direction toward the drum interior is sprayed to the rear portion of the drum 20 because it has a speed element toward the drum interior. As a result, the wash water may be supplied to the rear portion in the drum 20 along a horizontal direction via the spray holes 110 connected with the paths 120 extended in a horizontal direction toward the drum interior. It is possible to adjustably drop the wash water at different spots in the drum 20 according to the nozzle speed of the wash water.

[0070] As shown in FIG. 5, for example, the paths 120 connected with the spray holes 110 formed along direction 'a' may be extended horizontally toward the drum inside. The paths 120 connected with the spray holes 110 formed along direction 'b' may be extended relatively short toward the drum interior. Here, it is possible that a portion of each spray hole 110 is stepped from each other to differentiate an extending length of each path 120 toward the drum interior.

[0071] The spray hole 110 formed along the direction 'a' with a relatively smaller cross section is connected with the path 120 extended horizontally toward the drum interior and the spray hole 110 formed along the direction 'b' with a relatively larger cross section is connected with the path 120 formed in a vertical direction. As a result, the wash water sprayed via the spray hole 110 along the direction 'a' is sprayed along a drum inside direction with a horizontal speed element at a high pressure, such that it may be sprayed to the rear portion of the drum 20 along a vertical direction. The wash water via the spray hole 110 formed in the direction 'b' has a vertical speed element at a low pressure, such that it is dropped near the front portion of the drum 20 and is not sprayed further to the rear portion.

[0072] Because of the circulation nozzle 110, the water may be uniformly sprayed from the front portion to the rear portion of the drum 20 along a vertical direction of the drum 20.

[0073] In the meantime, according to the controlling method of the embodiment, in case the rinsing is performed while rotating the drum 20 after the water supplying step, the rinsing may be performed in a similar way of the conventional rinsing. However, it is preferable that penetration rinsing may be performed.

[0074] Penetration rinsing is performed while rotating the drum 20 at a relatively high speed at which the laundry is closely in contact with the inner circumferential surface of the drum 20 during the rotation of the drum 20. In this case, the wash water contained in the laundry is penetrated through the laundry and discharged outside the drum 20 by centrifugal force during the rinsing.

[0075] The drum 20 is rotated at a relatively high speed in this penetration rinsing operation, compared with the rotation speed in a conventional rinsing operation. As mentioned above, in order to prevent the rotating drum 20 from being given a resistance force by the wash water, it is preferable that the wash water is supplied enough to maintain the water level lower than the distance between the tub and the drum 20.

[0076] In the meantime, the wash water is circulated to the upper portion of the tub and of the drum 20 by the circulation unit as mentioned above, and it is repeatedly supplied to the drum 20. This wash water is penetrated through the laundry by the re-rotation of the drum 20 at a high speed. Hence, the wash water is discharged outside the drum 20 and it is held in the lower portion of the tub along an inner surface of the tub. The wash water held in the tub is re-circulated to the upper portion of the tub and the upper portion of the drum 20 by the circulation unit to be supplied to the drum interior.

[0077] If the wash water is supplied to the rear portion of the drum 20 along a vertical direction of the drum 20 by the circulation nozzle 100, the wash water may be supplied to the laundry uniformly, and the drum 20 is rotated to perform the penetration operation, which makes it possible to enhance rinsing efficiency.

[0078] In the meantime, referring to FIG. 3, if the drum 20 is rotated at the second speed in both the water supplying step and the rinsing step, the second speed may be selectable appropriately to enhance water supplying and rinsing efficiency, for example, between approximately 100 to 450 rpm which is higher than the minimum drum speed.

[0079] Here, the spinning (S210), water draining (S230), water supplying (S250) and rinsing (S270) steps may be performed at one time. As shown in FIG. 3, it is preferable that those steps are performed at least two times so that rinsing efficiency may be improved.

[0080] In addition, according to the controlling method of this embodiment, the rinsing course may further include a tumbling rinsing step (S300) next to the above spinning (S210), the water draining (S230), the water supplying (S250) and the rinsing (S270). The tumbling rinsing step (S300) is performed in a similar way to the conventional rinsing of the conventional washing machine and its detailed explanation will be omitted.

[0081] FIG. 4 is a graph illustrating a rotation speed of the drum 20 of the washing machine according to another embodiment of the controlling method. In this embodiment, a rotation speed during the water supplying and rinsing step is different, compared with the embodiment of FIG. 3. Next, the difference will be described.

[0082] According to the controlling method of this embodiment, the drum 20 is rotated at the second speed during the water supplying step (S250), and the drum may be rotated at a third speed during the rinsing step (S270).

[0083] Here, like the above embodiment, the second speed may be preset as high as the minimum speed at which the laundry is not spaced apart from the inner circumferential surface of the drum 20. However, it is preferable in this embodiment that the second speed is preset lower than the second speed of the above embodiment shown in FIG. 3.

[0084] Specifically, since the water supplying and the rinsing are performed at the identical drum rotation speed in the embodiment of FIG. 3, the rotation speed is preset relatively higher than the minimum drum speed to satisfy the efficiency of water supplying and rinsing. In contrast, since the rotation speed of the drum during the water supplying is different from the rotation speed during the rinsing in this embodiment of Fig. 4, the second speed of the drum during the water supplying is preset lower than the second speed of the embodiment shown in FIG. 3, which is higher than and similar to the minimum drum speed, for example, 100 ~ 110 rpm. If the water is supplied at this rotation speed of the drum, water supplying is performed more smoothly.

[0085] To perform the penetration rinsing step, the drum 20 is rotated at a third speed and it is preferable that the third speed is preset to be higher than the minimum drum speed as mentioned above. That is, in case of performing the penetration rinsing step, the laundry is closely in contact with the inner circumferential surface of the drum 20 so as not to be spaced apart therefrom.

[0086] In this case, the third rotation speed is preset to be higher than the minimum drum speed at which the laundry is not spaced apart from the inner circumferential surface of the drum 20. It is preferable that the third speed is lower than the first speed and higher than the second speed. If the drum 20 is rotated at the third speed to perform the penetration rinsing step, the drum 20 should be rotated at a predetermined speed higher than the second speed of the water supplying step to perform rinsing. Furthermore, the object of the penetration rinsing is not to dehydrate the laundry and it is preferable that the third speed of the penetration rinsing step is lower than the first speed of the spinning step.

[0087] The spinning step (S210), the water draining step (S230), the water supplying step (S250) and the penetration rinsing step (S270) may be performed only one time, respectively. However, as shown in FIG. 3, it is preferable that they may be performed more than one time repeatedly to enhance the rinsing efficiency of the washing machine.

[0088] According to the controlling method of this embodiment, the rinsing cycle may further include at least one tumbling rinsing step (S300) after the spinning step (S210), the water draining step (S230), the water supplying step (S250) and the penetration rinsing step (S270) are performed. The tumbling rinsing step (S300) may be performed similar to the rinsing step of the conventional washing machine and its detailed explanation will be omitted.

[0089] The controlling method according to the embodiment is explained, however, with reference to the front loading type washing machine and the present invention is not limited thereto. It may be applicable to other kinds of washing machines capable of performing rinsing while rotating the drum, for example, a top loading type drum washing machine.

[0090] The rinsing cycle of the overall washing course including the washing, rinsing and spinning cycle is explained in the above description and the present invention is not limited thereto. For example, the controlling method according to the embodiment may be applicable to a case where only the rinsing cycle is performed. If the order of each step in the rinsing cycle of FIG. 2 is adjusted, the controlling method can be applicable to the case in that only the rinsing cycle is performed. That is, if only the rinsing is performed, wash water is not supplied to the tub. As a result, the water supplying is performed first and the penetration rinsing step is performed. After that, the spinning step and the water draining step may be performed. The detailed explanation of each step is identical to that of each step in the above embodiment and it is omitted.

[0091] As mentioned above, according to the controlling method, a time taken to perform a rinsing cycle may be reduced.

[0092] Furthermore, rinsing efficiency may be improved together with the reduced time of the rinsing cycle.

[0093] 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 covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A controlling method of a washing machine compris-

ing:

rotating a drum at a first speed to extract water from the laundry;
removing water from a tub;
supplying water to the tub while rotating the drum at a second speed; and
supplying water to the drum while rotating the drum to rinse the laundry.

2. The controlling method of claim 1, wherein the first speed is more than 600 rpm to dehydrate the laundry.

3. The controlling method of claim 1 or 2, wherein in the step of removing water, the rotation speed of the drum is reduced until a predetermined speed higher than a minimum drum speed at which the laundry is closely in contact with an inner circumferential surface of the drum.

4. The controlling method of any of claims 1 to 3, wherein the second speed is equal to or higher than a minimum drum speed at which the laundry is closely in contact with the inner circumferential surface of the drum.

5. The controlling method of any of claims 1 to 4, wherein in the step of supplying water to the tub, water is supplied up to a predetermined height lower than a distance between the tub and the drum.

6. The controlling method of any of claims 1 to 5, wherein in the step of supplying water to the drum, water held in the tub is circulated during the rotation of the drum.

7. The controlling method of any of claims 1 to 6, wherein in the step of supplying water to the drum, the circulated water is supplied in at least one of a horizontal direction and a vertical direction along an inside of the drum.

8. The controlling method of any of claims 1 to 7, wherein in the step of supplying water to the drum, the drum is rotated at a speed such that the water penetrates through the laundry closely in contact with an inner circumferential surface of the drum to perform rinsing.

9. The controlling method of any of claims 1 to 8, further comprising rotating the drum at the second speed during the step of supplying water to the drum and preferably further comprising rotating the drum at a third speed different from the second speed during the step of supplying water to the drum and more preferably further comprising rotating the drum at a third speed higher than the second speed during the step of supplying water to the drum.

10. A controlling method of a washing machine having a tub and a drum within the tub, the method comprising:

rotating the drum to extract water from the laundry;
removing water from the tub;
supplying water to the tub while rotating the drum so that the laundry is distributed around an inner circumferential surface of the drum and in close contact with the inner circumferential surface of the drum; and
supplying water to the drum while rotating the drum while the laundry is distributed around the inner surface of the drum and in close contact with the inner circumferential surface of the drum.

11. The controlling method of claim 10, further comprising rotating the drum during the step of supplying water to the drum at a speed that is the same as a speed at which the drum is rotated during the step of supplying water to the tub.

12. The controlling method of claim 10, further comprising rotating the drum during the step of supplying water to the drum at a speed that is different from a speed at which the drum is rotated during the step of supplying water to the tub and preferably further comprising rotating the drum during the step of supplying water to the drum at a speed that is faster than a speed at which the drum is rotated during the step of supplying water to the tub.

13. The controlling method of any of claims 10 to 12, wherein the laundry is relatively uniformly distributed around the inner circumferential surface of the drum during the steps of supplying water to the tub and supplying water to the drum.

14. The controlling method of any of claims 1 to 13, further comprising supplying the water to the drum by spraying.

15. The controlling method of any of claims 1 to 14, wherein rotation of the drum is about a non-vertical axis.

FIG. 1

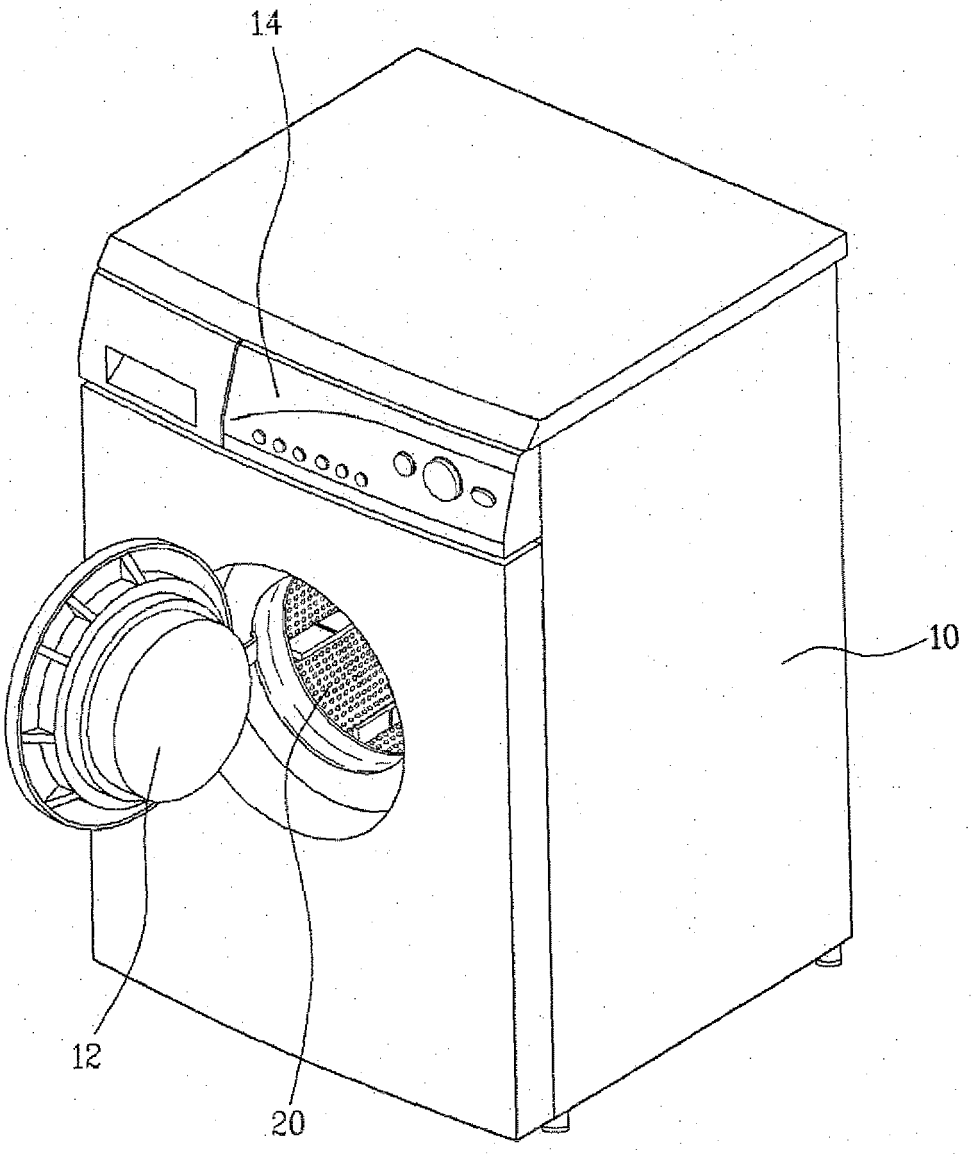


FIG. 2

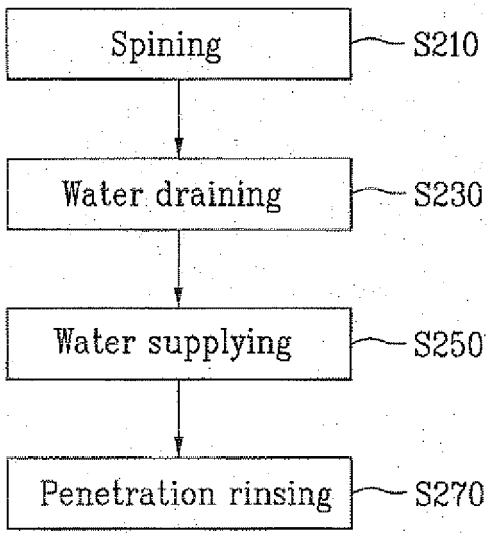

Spining
S210
Water draining
S230
Water supplying
S250
Penetration rinsing
S270

FIG. 3

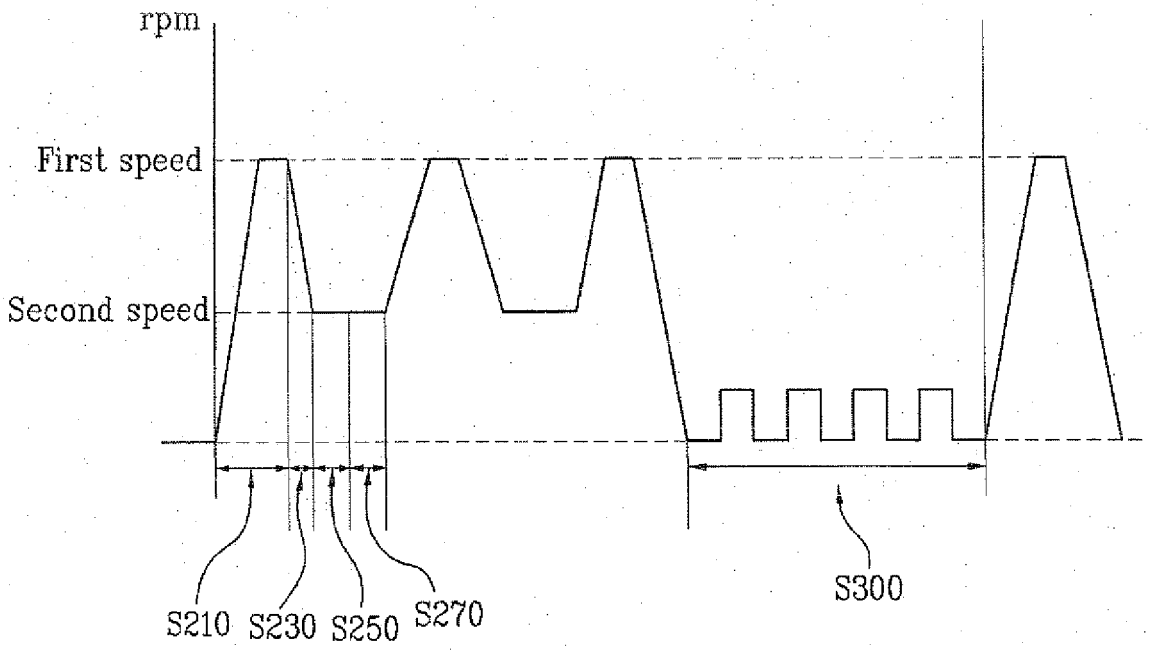


FIG. 4

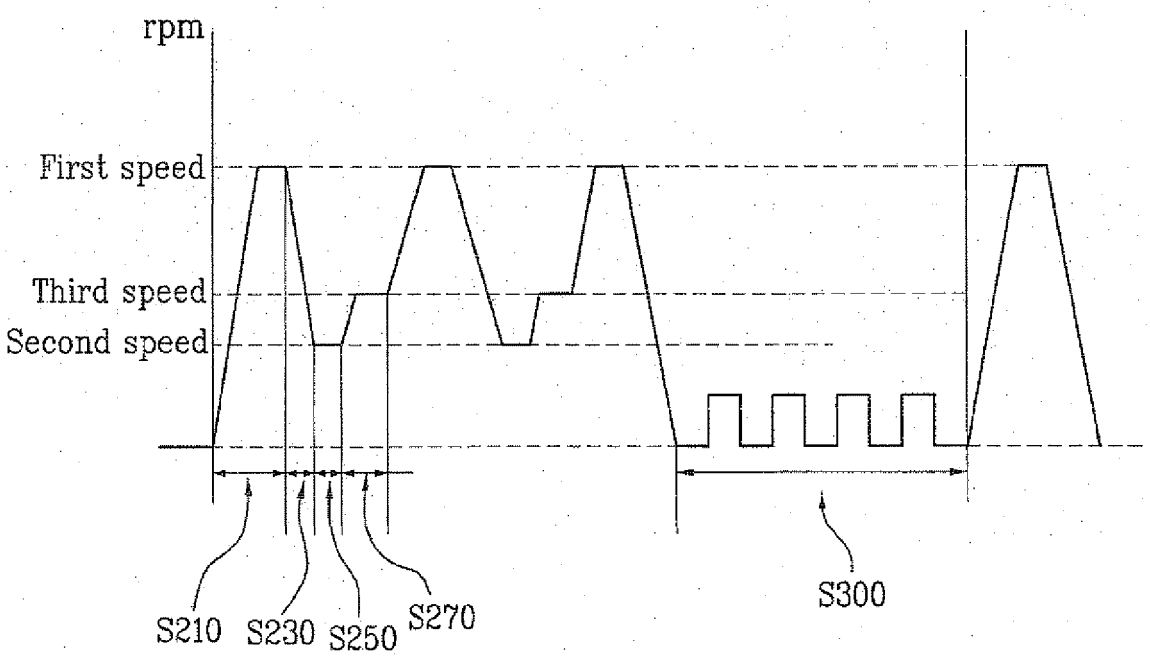
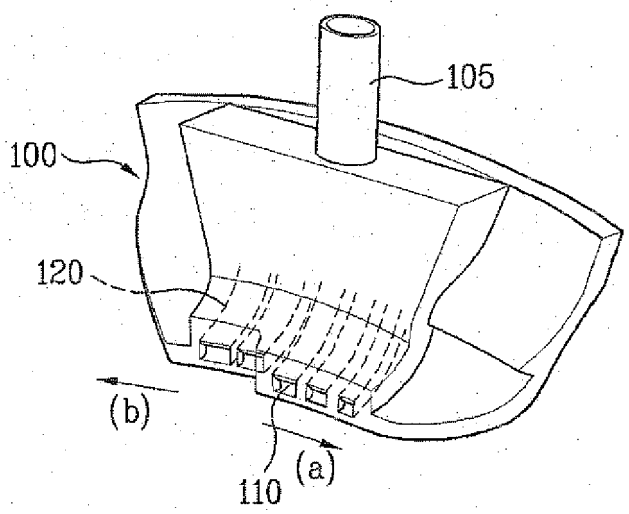

rpm
First speed
Third speed
Second speed
S210
S230
S250
S270
S300

FIG. 5



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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