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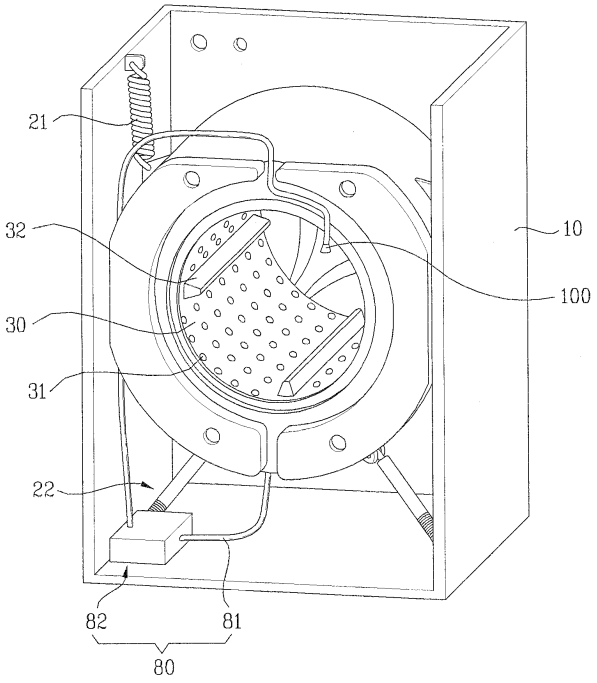
(54) **Washing machine**

(57) A circulatory washing machine, in which water stored in the bottom of a tub is circulated and supplied to a drum. The washing machine includes a tub for containing washing water; a drum rotatably installed in the tub; a circulation unit for circulating the washing water stored in the tub to the upper portion of the drum; and a spray nozzle for spraying the washing water, circulated by the circulation unit, to the rear portion of the inside of the drum.

Fig. 1



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Description

[0001] This application claims the benefit of Korean Patent Application No. 10-2008-0032618, filed April 8, 2008, which is hereby incorporated by reference as if fully set forth herein.

[0002] The present invention relates to a washing machine, and more particularly, to a circulatory washing machine, in which water stored in the bottom of a tub is circulated and supplied to a drum.

[0003] Generally, washing machines are pulsator washing machines, in which a drum is vertically erected, and drum washing machines, in which a drum is laid horizontally.

[0004] A conventional drum washing machine includes a case forming the external appearance of the washing machine, a door installed at an opening formed through the front surface of the case, a tub installed in the case for containing washing water, and a drum rotatably installed in the tub.

[0005] The drum contains laundry to be washed, and receives the washing water contained in the tub by through-holes formed through the circumferential surface of the drum. The drum is rotated by a driving unit, and thus the laundry in the drum is washed.

[0006] The tub contains the washing water, and causes the laundry contained in the drum to be washed and rinsed. A drain hole for discharging the washing water to the outside is formed at the lower portion of the tub.

[0007] In the drum washing machine, laundry is put into the drum through the door formed through the front surface of the case. Then, washing water is supplied to the tub, and the laundry in the drum, and is elevated and dropped by the rotation of the drum and thus washed.

[0008] Further, when the washing of the laundry is finished, a dehydrating operation is performed, in which the drum is rotated at a high velocity and the washing water contained in the laundry is discharged to the outside of the drum by the centrifugal force. The washing water discharged to the outside of the drum is discharged to the outside of the washing machine through the drain hole formed at the lower end of the tub.

[0009] The above drum washing machine is advantageous in that it washes laundry with a small amount of washing water compared with a pulsator washing machine.

[0010] However, in order to smoothly perform the washing and rinsing of the laundry using the drum washing machine, the washing water supplied to the tub must be supplied up to at least the height of the laundry contained in the drum. In a situation where the washing water cannot be supplied up the height of the laundry contained in the drum, the washing water stored in the bottom of the tub cannot be substantially used.

[0011] Particularly, if the washing water is absorbed into dry laundry in the initial stage of the operation and thus the level of the washing water is lower than an expected level, the washing and rinsing of the laundry cannot be properly performed.

[0012] Accordingly, the present invention is directed to a washing machine.

[0013] One object of the present invention is to provide a washing machine, in which water stored in a tub is uniformly supplied to laundry in a drum, thus smoothly washing and rinsing the laundry with a small amount of washing water.

[0014] To achieve this object and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a washing machine includes a tub for containing washing water; a drum rotatably installed in the tub; a circulation unit for circulating the washing water stored in the tub to the upper portion of the drum; and a spray nozzle for spraying the washing water, circulated by the circulation unit, to the rear portion of the inside of the drum.

[0015] 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.

[0016] 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. In the drawings:

[0017] FIG. 1 is a perspective view illustrating the inside of a washing machine in accordance with a first embodiment of the present invention;

[0018] FIG. 2 is a longitudinal-sectional view of the washing machine of FIG. 1;

[0019] FIG. 3 is a schematic view illustrating the spray of washing water by a spray nozzle of FIG. 1;

[0020] FIG. 4 is a perspective view of the spray nozzle of FIG. 1;

[0021] FIG. 5 is a plan view of the spray nozzle of FIG. 1;

[0022] FIG. 6 is a perspective view of a spray nozzle of a washing machine in accordance with a second embodiment of the present invention;

[0023] FIG. 7 is a schematic view illustrating the spray of washing water by the spray nozzle of FIG. 6;

[0024] FIG. 8 is a perspective view illustrating the inside of a washing machine in accordance with another embodiment of the present invention; and

[0025] FIG. 9 is a perspective view of a spray nozzle of a washing machine in accordance with another embodiment of the present invention.

[0026] Reference will now be made in detail to the preferred 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.

[0027] Hereinafter, a washing machine in accordance with a first embodiment of the present invention will be

described with reference to the drawings.

[0028] FIG. 1 is a perspective view illustrating the inside of the washing machine in accordance with the first embodiment of the present invention, and FIG. 2 is a longitudinal-sectional view of the washing machine of FIG. 1.

[0029] The washing machine of this embodiment includes an outer case 10 forming the external appearance of the washing machine, a tub 20 installed in the outer case 10 for containing washing water, and a drum 30 rotatably installed in the tub 20.

[0030] The outer case 10 protects various components installed therein, and forms the external appearance of the washing machine.

[0031] The tub 20 is supported in the outer case 10 by a spring 21 and dampers 22, and contains washing water supplied from the outside through a water supply device 50.

[0032] The drum 30 for containing laundry is rotatably installed in the tub 20, and a driving unit 40 is installed on the rear end of the tub 20 and drives the drum 30. Here, a plurality of dehydration holes 31, through which the washing water flows into and out of the drum 30, are formed through the circumferential surface of the drum 30.

[0033] When the tub 20 contains more than a designated amount of the washing water, the washing water is supplied to the drum 30 through the dehydration holes 31, and in dehydration, the washing water contained in the laundry is discharged to the outside of the drum through the dehydration holes 31.

[0034] A plurality of lifters 32 are protruded from the inner circumferential surface of the drum 30 in the lengthwise direction of the drum 30. When the drum 30 is rotated by the driving unit 40, the lifters 32 lift up the laundry contained in the drum 30 in the rotating direction of the drum 30. Thus, the laundry is elevated and dropped by the rotation of the drum 3 0, thereby being washed.

[0035] A door 60, which can be opened and closed, is formed at the front surface of the drum 30 such that laundry can be put into and taken out of the drum 30 through the door 60.

[0036] A gasket 70, which covers a gap between the front surface of the tub 20 and the rear surface of the door 60, such that the tub 20 containing the washing water forms a sealed space when the door 60 is closed, is formed in the circumferential direction. Preferably, the gasket 70 is made of an elastic member so as to absorb the vibration of the tub 20, and has a curved shape.

[0037] Further, preferably, the washing machine of this embodiment further includes a circulation unit 80 for circulating the washing water stored in the tub 20 to the upper portion of the drum 30.

[0038] The laundry put into the drum 30 is washed using the washing water contained in the tub 20. Thus, in a situation where the washing water contained in the tub 20 cannot reach the height of the drum 30, it is not easy to use the washing water. Accordingly, the washing machine of this embodiment includes the circulation unit 80 so as to supply the washing water stored in the tub 20 to the drum 30, and thus in a situation where the amount of the washing water contained in the tub 20 is small, the washing or rinsing of the laundry can be performed using the washing water.

[0039] Specifically, the circulation unit 80 includes a circulation channel 81, which supplies the washing water stored in the tub 20 to the drum 30. In this embodiment, one end of the circulation channel 81 is installed at the lower end of the tub 20, and is extended upwardly along the outline of the tub 20.

[0040] Since the water stored in the lower portion of the tub 20 is pulled up along the circulation channel 81, the circulation unit 80 further includes a circulation pump 82, which pumps up the washing water along the circulation channel 81.

[0041] In one embodiment, the other end of the circulation channel 81 for discharging the washing water is located at the front region of the upper portion of the drum 30. Specifically, the other end of the circulation channel 81 passes through the upper portion of the gasket 70 or the tub 20, and discharges the washing water to the front region of the drum 30. Further, a spray nozzle 100 for supplying the washing water is provided at the other end of the circulation channel 81, from which the washing water is discharged.

[0042] Preferably, the spray nozzle 100 is located at a position separated from the front surface of the drum 30 by a designated interval so as to prevent the drum 30 from colliding with the spray nozzle 100 due to the vibration of the drum 30 generated during rotation.

[0043] In the present invention, since the washing water stored in the tub 20 is supplied to the drum 30 along the circulation channel 81 by the circulation unit 80, the laundry in the drum 30 can be washed or rinsed with a small amount of the washing water. Further, even in a situation where the tub 20 contains a sufficient amount of the washing water, washing water is additionally supplied to the drum 30 from the upper part, and rapidly soaks laundry in the drum 30 when the laundry is put into the drum 30.

[0044] The washing machine of this embodiment is operated in a penetration type washing method, in which the drum 30 is rotated at a high velocity by the driving unit 40 so as to wash or rinse the laundry in the drum 30.

[0045] Here, the penetration type washing method is where the laundry in the drum 30 is washed or rinsed by the rotation of the drum 30 at a high velocity such that the laundry is closely attached to the inner surface of the drum 30, differing from a general drum rotating velocity. At this time, the washing water contained in the laundry penetrates the laundry by the centrifugal force and is discharged to the outside of the drum 30, and thus the laundry is washed or rinsed.

[0046] Compared with a general washing method, in the penetration washing method, the drum 30 is rotated at a high velocity. Thus, so as to prevent the rotating

drum 30 from being affected by the resisting power due to the washing water contained in the tub 20, the supplied washing water may maintain a level lower than the lower surface of the drum 30.

[0047] The washing water is circulated upwardly by the circulation unit 80, and is continuously supplied to the inside of the drum 30. After the supplied washing water penetrates the laundry due to the high-velocity rotation of the drum 30, the washing water is discharged to the outside of the drum 30, and is stored in the bottom of the tub 20 along the inner wall of the tub 20.

[0048] Preferably, the spray nozzle 100 spraying the washing water circulated by the circulation unit 80 to the inside of the drum 30 is disposed so that the spray nozzle 100 sprays the washing water to the rear portion of the inside of the drum 30. Hereinafter, the spray nozzle 100 will be described in detail with reference to FIGs. 3 to 5.

[0049] FIG. 3 is a schematic view illustrating the spray of washing water by the spray nozzle 100, FIG. 4 is a perspective view of the spray nozzle 100, and FIG. 5 is a plan view of the spray nozzle 100.

[0050] Preferably, the drum 30 has a cylindrical shape provided with an opened front surface, and the spray nozzle 100 is installed at a position close to the front portion of the drum 30. In a situation where the washing water is supplied to only the front portion of the drum 30 by the spray nozzle 100, the washing water may not be supplied to the laundry located at the rear portion of the inside of the drum 30.

[0051] Thus, as shown in FIG. 4, the spray nozzle 100 of this embodiment is preferably configured such that it can spray the washing water to the rear portion of the drum 30 as well as the front portion of the drum 30. That is, the spray nozzle 100 is configured such that it can spray the washing water in various directions, so as to supply the washing water uniformly to the laundry contained in the drum 30.

[0052] Particularly, in a situation where the drum 30 is not rotated, the laundry in the drum 30 is concentrated on the lower end of the drum 30, which forms the lowermost position in the drum 30. Thus, the spray nozzle 100 preferably sprays the washing water uniformly to the drum 30 in the lengthwise direction of the lower end of the drum 30 so as to concentratively supply the washing water to the laundry even if the drum 30 is not rotated.

[0053] As shown in FIG. 5, the spray nozzle 100 includes a plurality of spray holes 110 turning toward the inside of the drum 30. Preferably, the respective spray holes 110 spray the washing water onto different falling positions in the lengthwise direction of the drum 30.

[0054] That is, the respective spray holes 110 spray the washing water onto different positions of the lower region of the drum 30, separated at a designated interval from the front portion to the rear portion of the drum 30, thus uniformly dispersing the washing water in the lengthwise direction of the drum 30.

[0055] Thus, as the laundry, which is closely attached to the inner circumferential surface of the drum 30 during washing or rinsing, is rotated together with the rotation of the drum 30, the washing water is supplied uniformly to the laundry. Further, even in a situation where the drum 30 is not rotated and thus the laundry is concentrated on the lower portion of the drum 30, it is possible to supply the washing water to the laundry.

[0056] The spray nozzle 100 may include a plurality of spray units, which are installed at different positions so as to branch off the washing water supplied by the circulation unit 80 into various directions (with reference to FIG. 8). However, a procedure of assembling the plurality of the spray units (100a, 100b, 100c, 100d) installed at different positions may be complicated.

[0057] Thus, the spray nozzle 100 in this embodiment preferably includes a plurality of the spray holes 110 formed through a single case, as shown in FIG. 5.

[0058] Further, in the present invention, the respective spray holes 110 preferably have different shapes or different channels. The spray nozzle 100 is located at the front portion of the drum 30 provided with an opening. In order to spray the washing water onto different positions from the front portion of the drum 30 to the rear portion of the drum 30, the spray holes 110 preferably have different washing water spray directions or spray velocities.

[0059] Here, the respective spray holes 110 have different cross-sectional areas such that hydraulic pressures of the washing water sprayed through the spray holes 110 can be different. In a situation where washing water is passed through channels having the same condition, the smaller the cross-sectional area of the spray hole is, the washing water is sprayed at a high hydraulic pressure, and the larger the cross-sectional area of the spray hole is, the washing water is sprayed at a low hydraulic pressure.

[0060] The washing water sprayed at a low hydraulic pressure is sprayed in a shape similar to that in natural falling, and the washing water sprayed at a high hydraulic pressure tends to proceed in the spraying direction rather than the shape of natural falling.

[0061] Thus, it is preferable that the washing water sprayed at a low hydraulic pressure is supplied to the front portion of the drum 30 adjacent to the position of the spray nozzle 100, and the washing water sprayed at a high hydraulic pressure is supplied to the rear portion of the drum 30.

[0062] On the other hand, velocity components of the washing water sprayed through the respective spray holes 100 may be different. Even if the washing water is sprayed through the same spray hole 100, the washing water may fall onto different positions according to the velocity component of the washing water.

[0063] Here, the spray nozzle 100 includes a plurality of channels 120, through which the washing water supplied from the circulation unit 80 passes, and the plurality of the channels 120 correspond to the plurality of the spray holes 110. The channels 120 have different shapes, and thus the washing water passed through the respective channels 120 are sprayed with different ve-

locity components.

[0064] For example, the washing water passed through the channel 120, which is formed in the vertical direction, falls just onto the front portion of the drum 30, and the washing water passed through the channel 120, which is extended in the inward direction of the drum 30, has a velocity component in the inward direction of the drum 30 and thus can be sprayed onto the rear portion of the drum 30.

[0065] Thus, the spray nozzle 100 is preferably configured such that the spray hole 110 connected to the longer length channel 120 extended in the inward direction of the drum 30 sprays the washing water to the more rear portion of the inside of the drum 30.

[0066] As shown in FIG. 5, the spray nozzle 100 in this embodiment employs the above-described principle.

[0067] The spray nozzle 100 includes a plurality of the spray holes 110 having different cross-sectional areas, and the spray holes 110 are connected to the channels 120 having different shapes.

[0068] The closer the spray hole 110 is disposed in the direction (a), the narrower the cross-sectional area of the spray hole 110. Conversely, the closer the spray hole 110 is disposed in the direction (b), the wider the cross-sectional area of the spray hole 110. Thus, the spray holes 110 disposed in the direction (a) spray the washing water at a high hydraulic pressure, and the spray holes 110 disposed in the direction (b) spray the washing water at a low hydraulic pressure.

[0069] Further, the channels 120 connected to the spray holes 110 disposed in the direction (a) are extended to a long length in the inward direction of the drum 30, and the channels 120 connected to the spray holes 110 disposed in the direction (b) are extended to a short length in the inward direction of the drum 30. Particularly, as shown in FIG. 5, the portion of the spray nozzle 110, on which the spray holes 120 are formed, has a stepwise shape so as to differentiate the lengths of the channels 120 extended in the inward direction of the drum 30.

[0070] In this case, the spray holes 110 disposed in the direction (a) spray the washing water having a high velocity component in the inward direction of the drum 30 at a high hydraulic pressure, and thus the washing water is supplied to the rear portion of the drum 30. On the other hand, the closer the spray holes 110 are disposed in the direction (b), the spray holes 110 spray the washing water having a lower velocity component in the inward direction of the drum 30 at a lower hydraulic pressure, and the washing water cannot reach the rear portion of the drum 30 and falls around the front portion of the drum 30.

[0071] Thus, the spray nozzle 100 in this embodiment can spray washing water uniformly to the inside of the drum 30 from the front portion to the rear portion of the drum 30 in the lengthwise direction of the lower end of the drum 30.

[0072] The spray nozzle 100 is installed at the front region of the upper portion of the drum 30. In a situation where one spray nozzle is installed, it is preferable that the spray nozzle is installed at the front region of the upper end of the drum 30.

[0073] However, in a situation where more than two spray nozzles are installed or an additional steam spray nozzle for supplying steam to the inside of the drum 30 is provided, the spray nozzles are installed at positions being close to designated sides such that they can be installed at symmetrical positions centered on the upper end of the drum 30.

[0074] FIG. 4 illustrates the spray nozzle 100, which is located at a position close to one side. In a situation where a steam spray nozzle or another spray nozzle (not shown) is installed, this nozzle is preferably installed at a position close to the other side so as to be symmetrical with the spray nozzle 100 of FIG. 4.

[0075] Even in a situation where the spray nozzle is located at a position close to one side, as described above, it is preferable that the channels 120 connected to the respective spray holes 110 are formed in directions corresponding to positions at which the washing water from the spray holes 110 falls. That is, the spray nozzle 100 in this embodiment supplies the washing water in the lengthwise direction of the lower end of the drum 30. Thus, it is preferable that the channels 120 are formed towards the center of the drum 30.

[0076] Here, as shown in FIG. 5, the surface of the spray nozzle 100, on which the spray holes 110 are formed, is inclined at a designated angle with the opened front surface of the drum 30. Particularly, it is preferable that the larger the distances of the spray holes 110 from the center of the drum 30 are, the closer the spray holes 110 are installed in the inward direction of the drum 30.

[0077] In this embodiment, it was verified by experiment that when the spray nozzle 100 is located at a position deviated from the center of the drum 30 at an angle of 35~45°, and the surface of the spray nozzle 100, on which the spray holes 110 are formed, is inclined at a designated angle of 5~10° with the opened front surface of the drum 30, the washing water is sprayed in the lengthwise direction of the lower end of the drum 30.

[0078] The angles can be varied according to the position of the spray nozzle 100, and can be varied in a designated range according to the hydraulic pressure of the sprayed washing water or the angles of the channels 120.

[0079] The first embodiment describes the washing machine which supplies washing water to the inside of the drum 30 in various directions using the spray nozzle 100 having a plurality of the spray holes 110.

[0080] Hereinafter, a washing machine in accordance with a second embodiment of the present invention will be described with reference to FIGs. 6 and 7. Some parts in this embodiment, which are substantially the same as those in the first embodiment, are denoted by the same reference numerals even though they are depicted in different drawings, and a detailed description thereof will thus be omitted because it is considered to be unneces-

sary.

[0081] Although the first embodiment describes the washing machine, which supplies washing water to different positions using the spray nozzle 100 having a plurality of the spray holes 110, the second embodiment describes a washing machine including a spray nozzle 100 having one spray hole 110.

[0082] As shown in FIG. 6, the spray nozzle 100 sprays washing water through one spray hole 110. Preferably, the spray nozzle 100 has a channel 120, the width of which is gradually increased in the flowing direction of the washing water passing therethrough, such that the washing water passing through the spray nozzle 100 is dispersed in the width direction and is sprayed.

[0083] This structure employs a phenomenon, in which when the end of a hose connected to a water supply is pressed flatly, water passing through the end is widely dispersed at a high hydraulic pressure. Thus, even though the washing water is supplied through one spray hole 110, the washing water can be supplied to the inside of the drum 30 in various directions.

[0084] As shown in FIG. 6, the channel 120 formed in the spray nozzle 100 preferably has a shape in which the height of the cross-section of the channel 120 is gradually decreased in the flowing direction of the washing water. In this case, it is preferable that although the width of the channel 120 is increased in the flowing direction of the washing water, the cross-sectional area of the channel 120 is gradually decreased. Thus, the spray hole 110 spraying the washing water has a slim and long shape so as to form the smallest cross-sectional area of the channel 120.

[0085] Here, the cross-sectional area of the channel 120 of the spray nozzle 100 is decreased in the flowing direction of the washing water, and thus the hydraulic pressure of the washing water sprayed from the spray nozzle 100 is increased. Thus, the washing water is easily dispersed in the width direction, and is supplied to the inside of the drum at a high hydraulic pressure.

[0086] Further, guide ribs 130 for inducing the dispersion of the washing water in the width direction are provided in the channel 120, through which the washing water passes. The guide ribs 130 are disposed in the width direction, and are inclined in the flowing direction of the washing water, thus inducing the uniform dispersion of the washing water in the width direction.

[0087] FIG. 7 is a schematic view illustrating the spray of washing water by the spray nozzle 100 in accordance with this embodiment.

[0088] In the case that the spray nozzle 100 in this embodiment is installed such that the spray hole 110 is parallel with the front surface of the drum 30, although the drum 30 is rotated, washing water may not be supplied to a designated position in the drum 30. Thus, it is preferable that the spray hole 110 of the spray nozzle 100 is inclined at a designated angle with the front surface of the drum 30.

[0089] Further, as described in detail in the first embodiment, it is preferable that the spray nozzle 100 in this embodiment uniformly sprays washing water in the lengthwise direction of the lower end of the drum 30. Thus, it is preferable that the spray nozzle 100 is obliquely installed toward the drum 30 such that the washing water sprayed from one end of the spray hole 110 is supplied to the front portion of the lower end of the drum 30 and the washing water sprayed from the other end of the spray hole 110 is supplied to the rear portion of the lower end of the drum 30.

[0090] Thus, this embodiment provides a washing machine which supplies washing water continuously from the front portion to the rear portion of the lower end of the drum 30.

[0091] Hereinafter, a washing machine in accordance with a third embodiment of the present invention will be described with reference to FIG. 9. Some parts in this embodiment, which are substantially the same as those in the first and second embodiments, are denoted by the same reference numerals even though they are depicted in different drawings, and a detailed description thereof will thus be omitted because it is considered to be unnecessary.

[0092] The first and second embodiments respectively describe the washing machines in which the spray directions of washing water are adjusted by the shape and position of the spray nozzle 100. On the other hand, the third embodiment describes a washing machine, in which the direction of washing water sprayed from a spray nozzle 100 is adjusted by a driving part 150, such as a motor. That is, in this embodiment, washing water is not sprayed in various directions concurrently, but the spray direction of the washing water continuously varies using the driving part 50.

[0093] As shown in FIG. 9, the spray nozzle 100 includes a body part 140, which sprays washing water, and the driving part 150, which adjusts the spray position of the washing water.

[0094] Washing water circulated by the circulation unit 80 is supplied to the body part 140, and the body part 140 includes spray holes 110 which spray the washing water to the drum 30. Preferably, the body part 140 is configured such that it can be fixed to the driving part 150 and vary the spray direction of the washing water by the control of the driving part 150.

[0095] The driving part 150 is fixed to the inside of the tub 20 in front of the drum 30, and is provided with a driving device (not shown), such as a motor, therein. Thus, the driving device is driven by the supply of power, thus rotating the body part 140 or changing the direction of the body part 140. The motor may be an electric motor powered by electricity, or a fluid motor powered by the flow of the washing water from the circulation unit 80.

[0096] As shown in FIG. 9, in this embodiment, both sides of the body part 140 are respectively fixed to the driving part 150. The body part 140 is rotated at a designated angle on a shaft formed at both side surfaces, and sprays washing water in various directions.

[0097] In this case, the falling position of the washing water sprayed by the body part 140 continuously varies, and preferably reciprocates from the front end to the rear end of the lower portion of the drum 30.

[0098] Although this embodiment describes the spray nozzle 100 having a shape shown in FIG. 9, the present invention is not limited thereto. Besides, the present invention may be applied to various machines including a laundry treating machine, in which a spray nozzle adjusts the spray direction of washing water using a driving device.

[0099] As described above, although the three embodiments of the present invention have been disclosed for illustrative purposes, the present invention is not limited to the above-described shapes and positions. Further, various modifications, additions and substitutions are possible as far as washing water can be supplied to the inside of the drum in various directions by adjusting the hydraulic pressure of the spray nozzle spraying the washing water and the direction(s) of the channel(s), or using a driving device, such as a motor.

[0100] The washing machine of the present invention reduces the amount of the washing water required to wash and rinse laundry to save water, and supplies the washing water uniformly to the laundry contained in the drum through the spray nozzle to enhance the laundry washing and rinsing effects.

[0101] 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 inventions. 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 washing machine, comprising:

a tub for containing washing water;
a drum rotatably installed in the tub for rotation about a generally horizontal axis;
a circulation unit for circulating the washing water stored in the tub to the drum; and
a spray nozzle for spraying the washing water, circulated by the circulation unit, along the inside of the drum from a front portion of the drum to a rear portion of the drum.

2. The washing machine according to claim 1, wherein the spray nozzle sprays the washing water such that the washing water is dispersed in the lower portion of the drum.

3. The washing machine according to claim 1 or 2, wherein the spray nozzle includes a plurality of spray holes adapted to spray the washing water to different falling positions in the lengthwise direction of the drum.

4. The washing machine according to claim 3, wherein at least two of the spray holes have different cross-sectional areas to spray the washing water to the different falling positions.

5. The washing machine according to claim 4, wherein the spray nozzle includes a driving part to adjust the spray position of the washing water into the drum.

6. The washing machine according to any of claims 3 to 5, wherein the spray nozzle includes a plurality of channels which receive the washing water from the circulation unit and allow the washing water to flow to the plurality of the spray holes, and the respective spray holes spray the washing water to the different falling positions according to lengths of the channels corresponding to the spray holes.

7. The washing machine according to claim 6, wherein the longer length channel is configured to spray the washing water to the more rear portion of the inside of the drum.

8. The washing machine according to any of claims 3 to 7, wherein the channels connected to the respective spray holes are formed in directions corresponding to the falling positions.

9. The washing machine according to claim 8, wherein a surface of the spray nozzle, on which the spray holes are formed, forms a plane inclined with respect to the front surface of the drum.

10. The washing machine according to any of claims 1 to 9, wherein the spray nozzle includes a channel, the channel having a width which increases in the flowing direction of the washing water, such that the washing water passing through the spray nozzle is dispersed in the width direction of the spray nozzle.

11. The washing machine according to claim 10, wherein the channel of the spray nozzle is gradually decreased in a thickness direction and elongated in the width direction.

12. The washing machine according to claim 11, wherein the spray nozzle includes a long narrow spray hole formed in the width direction so as to disperse and spray the washing machine at a high pressure.

13. The washing machine according to claim 12, wherein the spray nozzle includes guide ribs, which induce the flowing direction of the washing water so as to disperse the washing water passing through the channel in the width direction.

14. The washing machine according to claim 12 or 13, wherein the spray nozzle is obliquely installed toward the drum such that one end of the spray hole sprays the washing water to the front portion of the lower end of the drum and the other end of the spray hole sprays the washing water to the rear portion of the lower end of the drum.

15. The washing machine according to any of claims 1 to 14, wherein the spray nozzle includes a plurality of spray units for spraying the washing water, the spray units being located at different positions so as to spray the washing water to different falling positions in the lengthwise direction of the drum.

16. The washing machine according to any of claims 1 to 15, wherein the spray nozzle sprays the washing water with a generally uniform distribution between the front portion of the drum and the rear portion of the drum.

Fig. 1

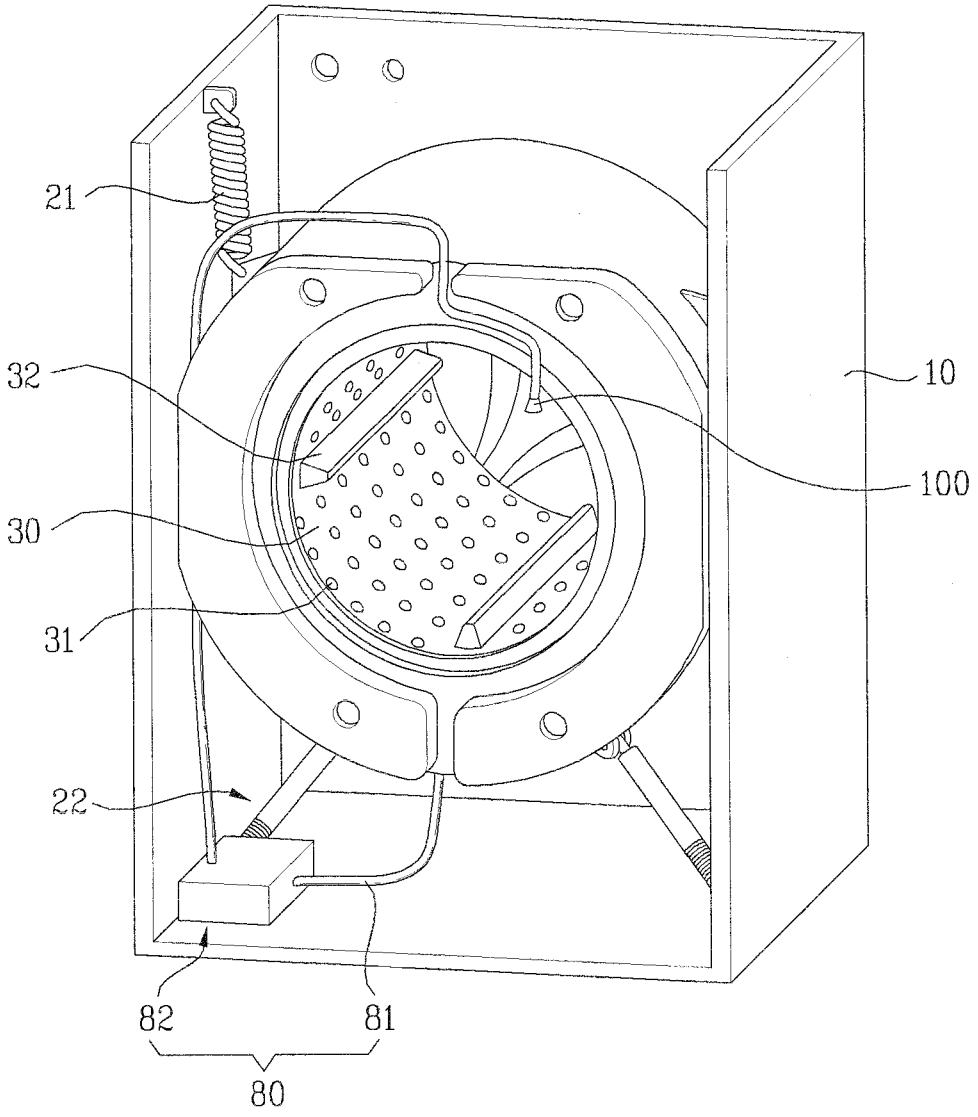


Fig. 2

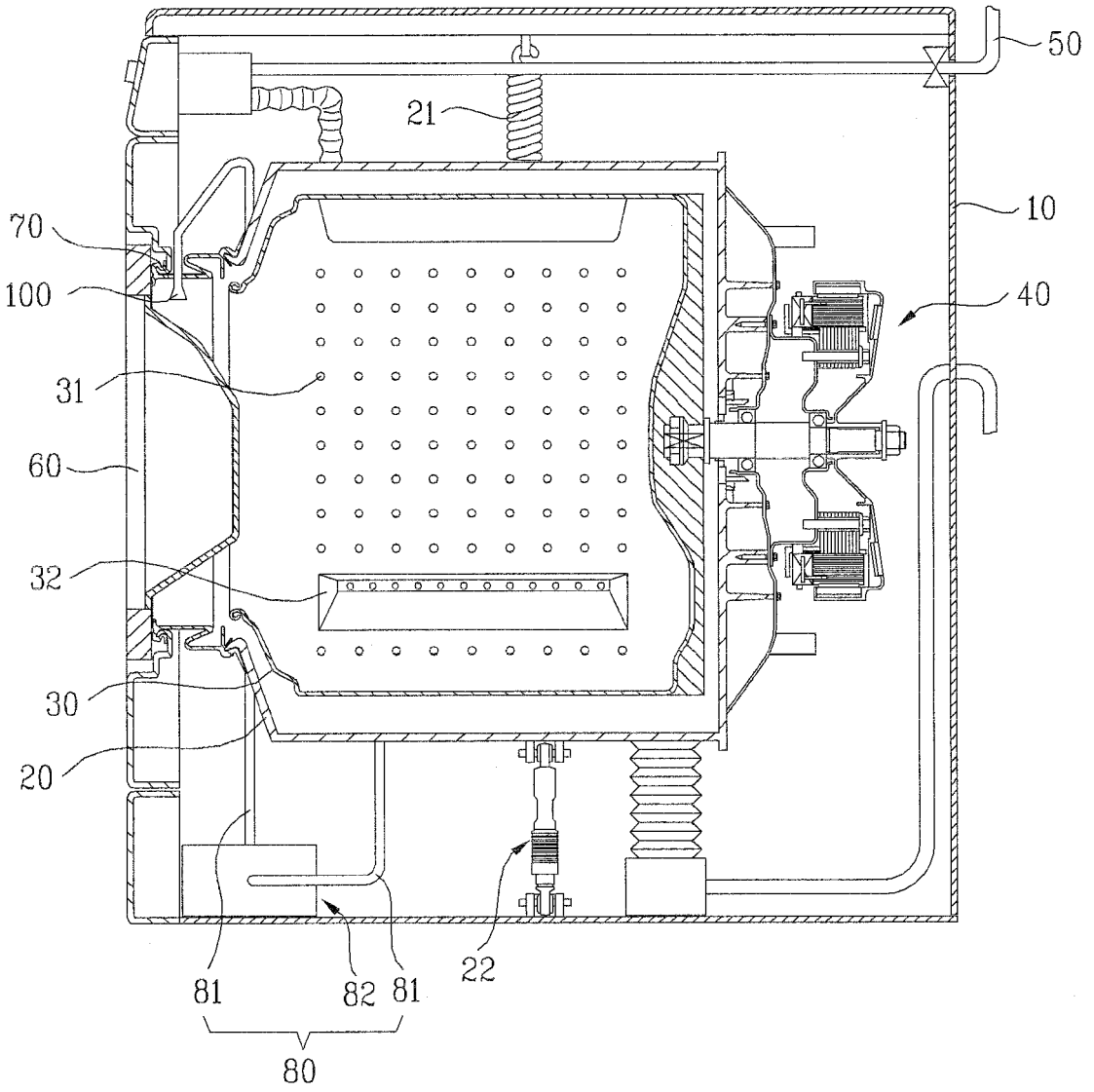


Fig. 3

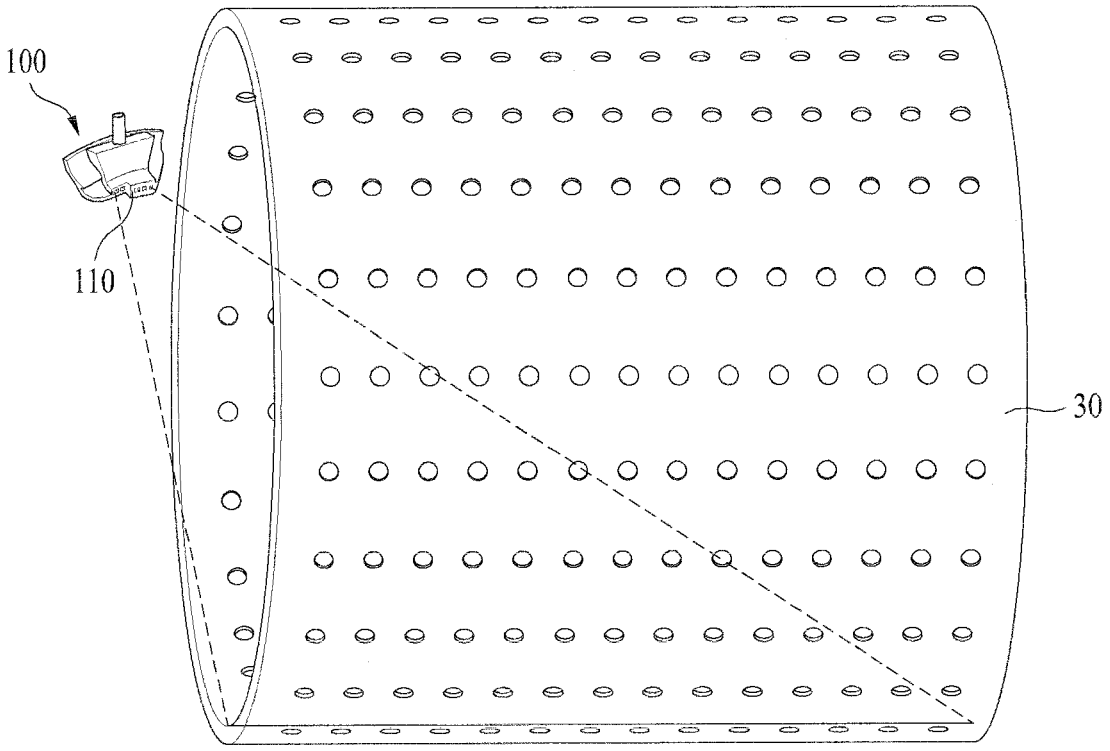


Fig. 4

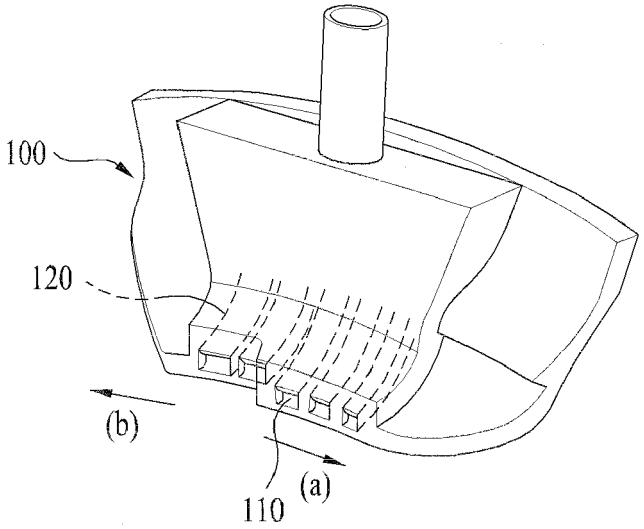


Fig. 5

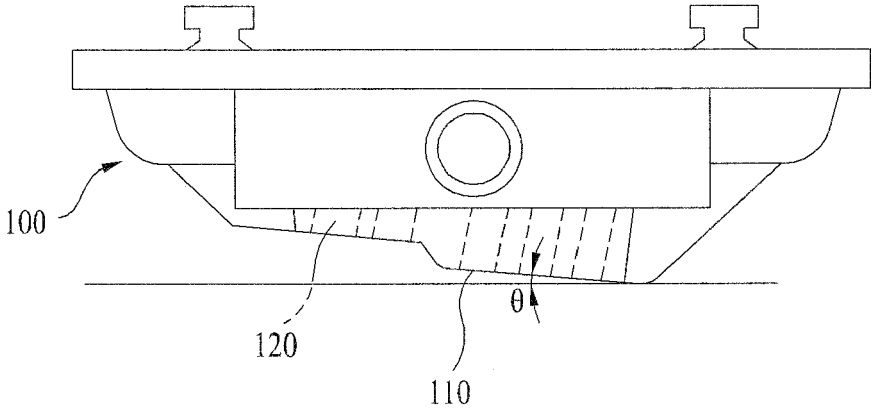


Fig. 6

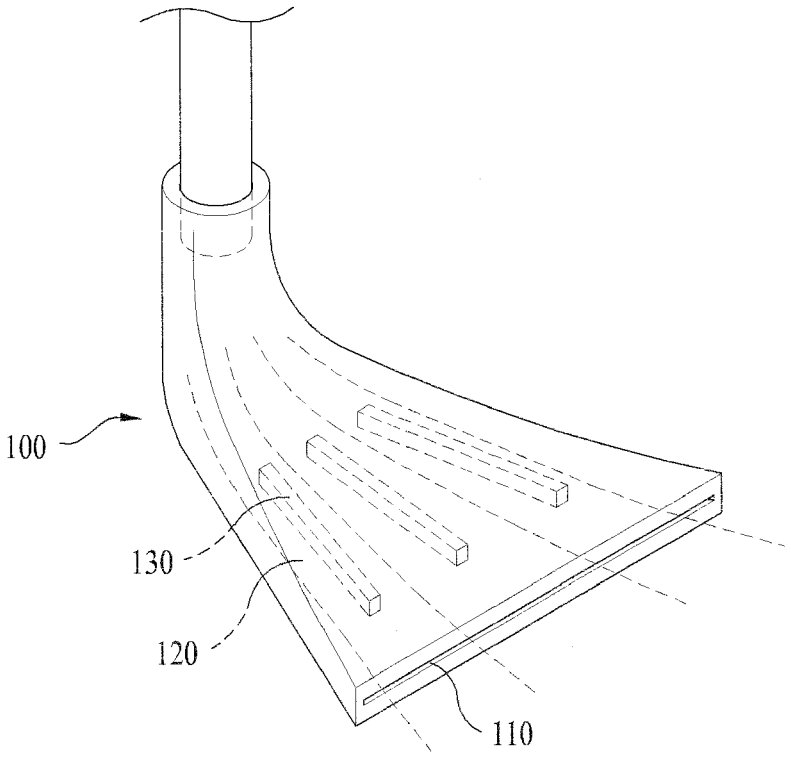


Fig. 7

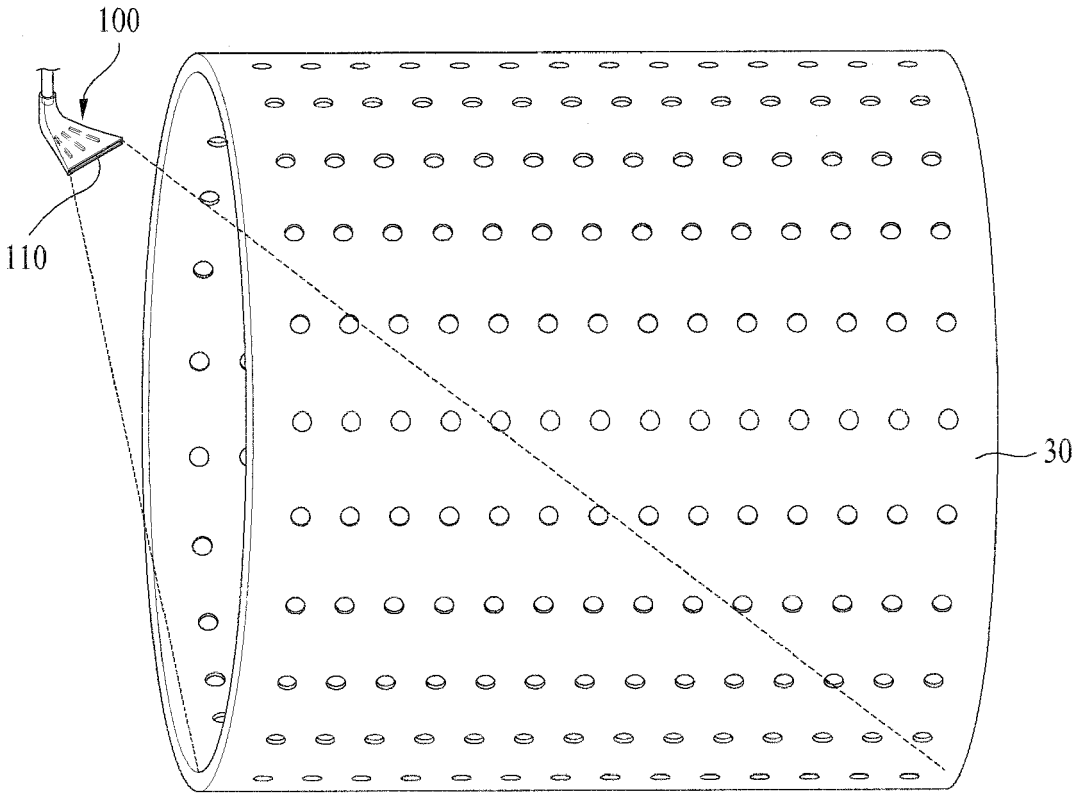


Fig. 8

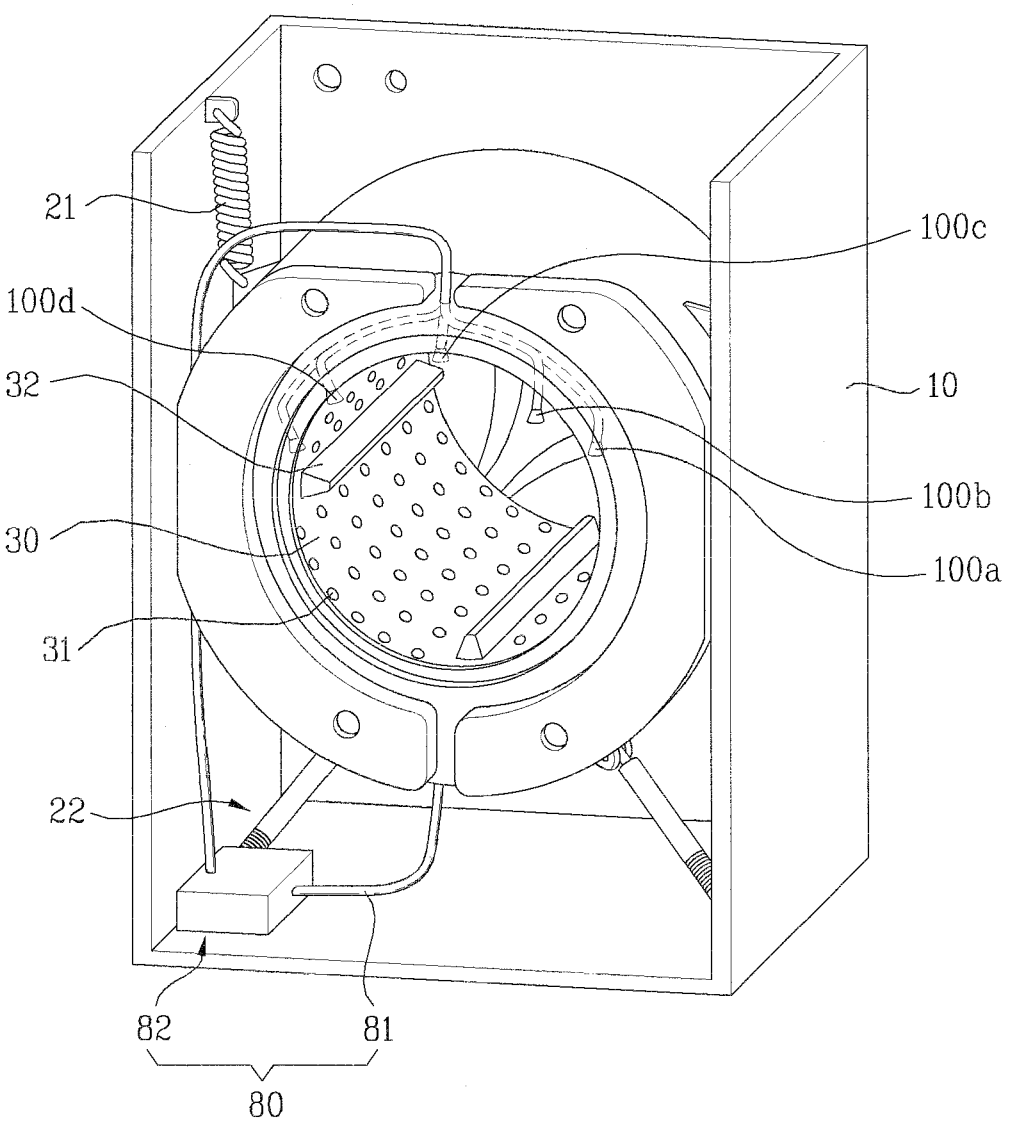
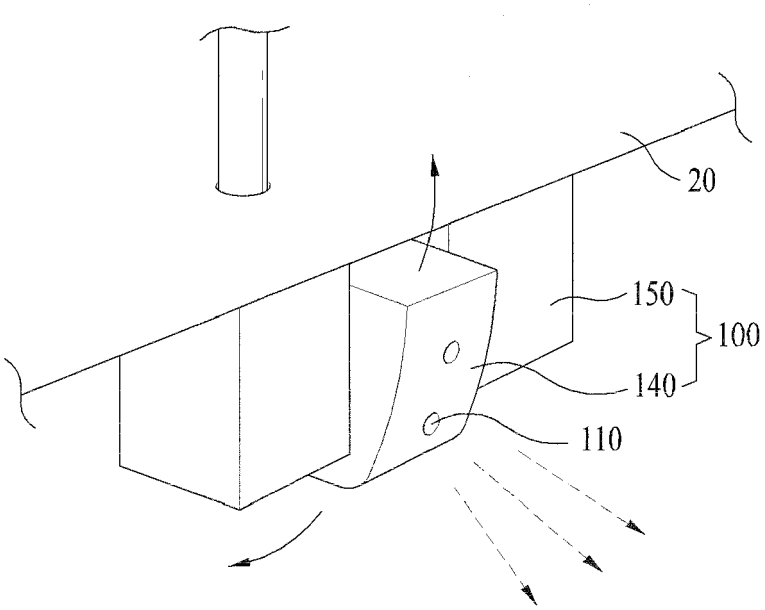


Fig. 9



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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