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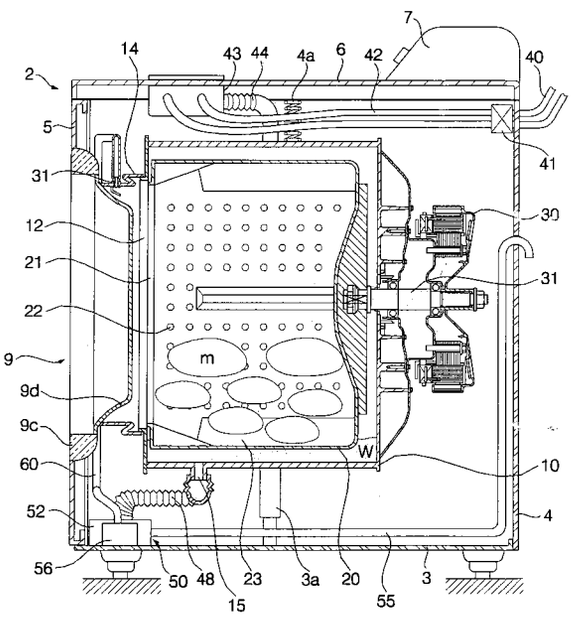
(54) Washing machine

(57) Disclosed is a washing machine provided with a nozzle(74) for spraying washing water(w) into a drum (20) at a broadened angle, thus improving washing efficiency and rinsing efficiency and reducing a quantity of the washing water(w) consumed. The washing machine comprises a tub(10) for containing washing water (w), a drum(20) rotatably arranged in the tub(10) for accommodating laundry(m), a motor(30) for rotating the drum(20), and a washing water-circulating device for circulating the washing water(w) so that the washing water (w) in the tub(10) is sprayed into the drum(20), wherein the washing water-circulating device includes a nozzle (74) having a vertical water-spraying angle in the range of 30° to 40°.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a washing machine, and more particularly to a washing machine provided with an improved nozzle for spraying washing water into a drum at a broadened angle.

Description of the Related Art

[0002] Generally, washing machines are apparatuses for removing contaminants from laundry by the action of detergent and water.

[0003] Such washing machines are divided into agitator-type washing machines, pulsator-type washing machines, and drum-type washing machines.

[0004] The agitator-type washing machine washes laundry placed therein by rotating a rod rising from a central area of a washing tank in both directions. The pulsator-type washing machine washes laundry placed therein by means of friction between the laundry and a water current generated by rotating a pulsator having a disk shape installed on a lower portion of a washing tank in both directions. The drum-type washing machine washes laundry placed in a drum by rotating the drum including a plurality of lifters protruded from an inner surface thereof and containing water, detergent and the laundry.

[0005] The above-described conventional washing machines, such as the agitator-type washing machines, the pulsator-type washing machines, and the drum-type washing machines, are provided with various subsidiary devices for increasing washing efficiency. For example, a washing water-circulating device is installed in the washing machines.

[0006] The washing water-circulating device causes water containing detergent or pure and clean water without detergent (hereinafter, referred to as "washing water") to soak into the laundry placed in the drum, thus reducing a quantity of the washing water. Further, the washing water-circulating device increases friction between the laundry and a current of the washing water, thus increasing washing capacity. Accordingly, the washing water-circulating device serves to pump the washing water placed in the lower portion of a tub and to spray the pumped washing water into the drum.

[0007] The washing water-circulating device includes a nozzle for spraying circulating washing water into the drum. The circulating washing water sprayed from the nozzle is required to be directed to the inside of the drum at a broadened angle.

SUMMARY OF THE INVENTION

[0008] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a washing machine provided with a nozzle for spraying washing water into a drum at a broadened angle, thus improving washing efficiency and rinsing efficiency, and reducing a quantity of the washing water consumed.

[0009] In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a washing machine comprising a tub for containing washing water, a drum rotatably arranged in the tub for accommodating laundry, a motor for rotating the drum, and a washing water-circulating device for circulating the washing water so that the washing water in the tub is sprayed into the drum, wherein the washing water-circulating device includes a nozzle having a vertical water-spraying angle in the range of 30° to 40°.

[0010] In accordance with a further aspect of the present invention, there is provided a washing machine comprising a tub for containing washing water, a drum rotatably arranged in the tub for accommodating laundry, a motor for rotating the drum, and a washing water-circulating device for circulating the washing water so that the washing water in the tub is sprayed into the drum, wherein the washing water-circulating device includes a nozzle having a horizontal water-spraying angle in the range of 110° to 130°.

[0011] In accordance with another aspect of the present invention, there is provided a washing machine comprising a tub for containing washing water, a drum rotatably arranged in the tub for accommodating laundry, a motor for rotating the drum, and a washing water-circulating device for circulating the washing water so that the washing water in the tub is sprayed into the drum, wherein the washing water-circulating device includes a nozzle having different right and left vertical water-spraying angles.

[0012] In accordance with yet another aspect of the present invention, there is provided a washing machine comprising a tub for containing washing water, a drum rotatably arranged in the tub for accommodating laundry, a motor for rotating the drum, and a washing water-circulating device for circulating the washing water so that the washing water in the tub is sprayed into the drum, wherein the washing water-circulating device includes a nozzle having different right and left horizontal water-spraying angles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a partially exploded perspective view of an embodiment of a washing machine in accordance

with the present invention;

Fig. 2 is a longitudinal-sectional view of the embodiment of the washing machine in accordance with the present invention;

Fig. 3 is a longitudinal-sectional view of a first embodiment of a nozzle of the washing machine in accordance with the present invention;

Fig. 4 is a partially exploded sectional view of the first embodiment of the nozzle, through which washing water is sprayed into a drum, in accordance with the present invention;

Fig. 5 is a cross-sectional view of a second embodiment of the nozzle of the washing machine in accordance with the present invention;

Fig. 6 is a rear view of a third embodiment of the nozzle of the washing machine in accordance with the present invention;

Fig. 7 is a partially exploded sectional view of the third embodiment of the nozzle, through which washing water is sprayed into the drum, in accordance with the present invention; and

Fig. 8 is a cross-sectional view of a fourth embodiment of the nozzle of the washing machine in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Now, preferred embodiments of the present invention will be described in detail with reference to the annexed drawings. In the drawings, the same or similar elements are denoted by the same reference numerals even though they are depicted in different drawings. In the following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear.

[0015] Fig. 1 is a partially exploded perspective view of an embodiment of a washing machine in accordance with the present invention. Fig. 2 is a longitudinal-sectional view of the embodiment of the washing machine in accordance with the present invention.

[0016] As shown in Figs. 1 and 2, the washing machine of the present invention comprises a casing 2, a tub 10 located in the casing 2 so that the tub 10 is stably supported by the casing 2 for containing washing water (w), a drum 20 rotatably arranged in the tub 10 for accommodating laundry (m), and a driving motor 30 for rotating the drum 20.

[0017] The casing 2 includes a base 3 provided with a damper 3a connected to the tub 10, a cabinet 4 located on the base 3 for surrounding both side surfaces and a rear surface of the tub 10 and provided with a spring 4a connected thereto for suspending the tub 10 therewith, a cabinet cover 5 arranged in front of the cabinet 4 for covering a front surface of the cabinet 4 and provided with an entrance hole 5a formed at a central area thereof for placing the laundry (m) into the tub 10 therethrough, a top plate 6 for covering an upper surface of the cabinet 4, and a control panel 7 installed on an upper surface of the cabinet cover 5 or the top plate 6 for controlling the washing machine.

[0018] A door 9 for opening and closing the entrance hole 5a is installed on the cabinet cover 5.

[0019] The door 9 includes a door frame 9c provided with an opening at a central area thereof and a locking unit 9b locked with the cabinet cover 5 and provided with one side connected to the cabinet cover 5 by a hinge 9a, and a door glass 9d installed at the opening of the door frame 9c and formed in a convex surface directed to the drum 20.

[0020] The tub 10 includes an opening 12 for allowing the laundry (m) to be put into the drum 20 therethrough, and a gasket 14 provided with a sealing portion, contacting a rear surface of the door frame 9c or the door glass 9d, around the opening 12, thereby preventing the washing water (w) from leaking from the tub 10 and the laundry (m) from being separated from the tub 10.

[0021] The drum 20 includes an entrance hole 21 formed through a front surface thereof for placing the laundry (m) into the drum 20 therethrough, a plurality of through holes 22 formed through a side surface and a rear surface thereof for allowing the washing water (w) to pass through the drum 20 therethrough, and lifters 23 formed on an inner circumference thereof for lifting and dropping the laundry (m). A lower portion of the drum 20 is submerged in the washing water (w) in the tub 10.

[0022] The driving motor 30 is installed on the rear surface of the tub 10. A rotary shaft 31 of the driving motor 30, which penetrates the rear surface of the tub 10, is supported by the tub 10 and connected to the rear surface of the drum 20.

[0023] A water supply unit is provided on the tub 10 for supplying the washing water (w) into the tub 10.

[0024] The water supply unit includes a water supply valve 41 connected to an external hose 40 for intermittently controlling clean water (w) supplied from the external hose 40, a water supply hose 42 for guiding the water passed through the water supply valve 41, a detergent box 43 including a detergent storing space, a water supply passage and an outlet for causing the water supplied from the water supply hose 42 to be mixed with detergent stored by the detergent storing space and then to be discharged therefrom, and a water supply bellows tube 44 having one end connected to the outlet of the detergent box 43 and the other end connected to an inlet formed at a designated position of the upper surface of the tub 10 for guiding the water or detergent discharged from the detergent box 43 into the tub 10.

[0025] A drainage hole 15 is formed through the lower surface of the tub 10 for discharging the washing water (w) to the outside therethrough, and is connected to a drainage bellows tube 48 for guiding the washing water (w) discharged from the tub 10.

[0026] A pump unit 50, for pumping out or re-circulat-

ing into the drum 20 the washing water (w) discharged from the tub 10 through the drainage hole 15 and the drainage bellows tube 48, is connected to the drainage bellows tube 48.

[0027] The pump unit 50 includes a filter case 52, a drainage pump 54, and a circulating pump 56.

[0028] The filter case 52 includes a connector connected to the drainage bellows tube 48, a passage, for passing the washing water (w) therethrough, connected to the drainage pump 54 and the circulating pump 56, and a filter for filtering foreign substances, such as waste pieces of thread, from the washing water (w).

[0029] A drainage hose 55 extended toward the outside of the casing 2 is connected to the drainage pump 54, and serves to discharge the washing water (w) introduced into the pump case 52 to the outside in a drain mode of the washing machine.

[0030] A circulating hose 60 extended toward the upper end of the gasket 14 is connected to the circulating pump 56, and serves to pump out the washing water (w) introduced into the filter case 52 in a wash or rinse mode of the washing machine.

[0031] One end of the circulating hose 60 is adjacent to the upper end of the gasket 14.

[0032] A spraying unit provided with a nozzle for spraying the guided washing water (w) into the drum 20 is connected to the circulating hose 60.

[0033] Fig. 3 is an enlarged longitudinal-sectional view of a first embodiment of a nozzle of the washing machine in accordance with the present invention. Fig. 4 is a partially exploded sectional view of the first embodiment of the nozzle, through which washing water is sprayed into a drum, in accordance with the present invention.

[0034] As shown in Figs. 3 and 4, the gasket 14 includes a cylindrical rib 14b, and a through hole 14a formed through the cylindrical rib 14b.

[0035] The spraying unit serves to spray the washing water pumped through the circulating hose 60 from the inside of the gasket 14 to the inside of the drum 20, and includes a cylinder 72 protruded from the upper end of the cylindrical rib 14b, connected to the circulating hose 60 and provided with a through hole 72a, located in the through hole 14a and the cylindrical rib 14b for passing the washing water (w) therethrough, and a nozzle 74 provided on a lower end of the cylinder 72 for spraying the washing water passed through the cylinder 72 into the drum 20 at a broadened angle.

[0036] A protrusion 72b, formed in a hook structure, is formed on an outer circumference of the cylinder 72 and caught by an upper portion of the cylindrical rib 14b, thereby preventing the cylinder 72 from coming out from the lower end of the gasket 14 due to a dead weight of the cylinder 72, a water flow and external vibration.

[0037] The cylinder 72 is pushed into the gasket 14 through the through hole 14a.

[0038] The nozzle 74 is formed integrally with the lower end of the cylinder 72, and located on the upper portion of the inside of the gasket 14.

[0039] The nozzle 74 has a vertical spraying angle (α) in the range of 30° to 40° so that the washing water (w) sprayed from the nozzle 74 is directed to the lower portion of the rear surface 26 or the circumferential portion 28 of the drum 20.

[0040] In case that the vertical spraying angle (α) of the nozzle 74 is excessively small, the sprayed washing water (w) is directed only to the upper portion of the rear surface 26 of the drum 20. In case that the vertical spraying angle (α) of the nozzle 74 is excessively large, the sprayed washing water (w) is directed only to the front part of the circumferential portion 28 of the drum 20. Accordingly, the vertical spraying angle (α) of the nozzle 74 is limited to 30° to 40° so that the sprayed washing water (w) is uniformly directed into the drum 20.

[0041] A rear surface of the nozzle 74 facing the rear surface 26 of the drum 20 is opened, and both side surfaces of the nozzle 74 are partially opened. The nozzle 74 includes an upper horizontal portion 75 protruded horizontally from the lower end of the cylinder 72, a front vertical portion 76 protruded perpendicularly from the upper horizontal portion 75, and a lower sloping portion 77 extended from a lower end of the front vertical portion 76 and located below the through hole 72a.

[0042] The front vertical portion 76 is bent from a front end of the upper horizontal portion 75.

[0043] In case that the lower sloping portion 77 has an excessively small nozzle height (H), which is a distance from the lower end of the through hole 72a to the lower sloping portion 77, it is difficult to efficiently spray the washing water (w). In case that the lower sloping portion 77 has an excessively large nozzle height (H), the lower sloping portion 77 interferes with the door glass 9d and a spraying length of the washing water (w) directed to the inside of the drum 20 is reduced. Accordingly, preferably, the lower sloping portion 77 has a nozzle height (H) in the range of 2mm to 4mm.

[0044] Preferably, the lower sloping portion 77 has a length (L) limited to the range of 20mm to 25mm so as to sufficiently guide the washing water (w) and prevent the interference with the door glass 9d located around the lower sloping portion 77.

[0045] When the through hole 72a of the cylinder 72 has a reduced diameter (d), the water spraying length of the lower sloping portion 77 is increased and a passage loss is increased. Accordingly, in case that the vertical spraying angle (α) of the nozzle 74 is in the range of 30° to 40°, it is preferable that the diameter (d) of the through hole 72a of the cylinder 70 is 0.4 to 0.65 times as large as the diameter (D) of the nozzle 74.

[0046] Hereinafter, operation of the washing machine of the present invention will be described in detail.

[0047] First, the laundry (m) is put into drum 20, and the door 9 is closed into the cabinet cover 5. Thereafter, the washing machine is operated. Then, the lower portion of the tub 10, the drainage bellows tube 48 and the filter case 52 are filled with the washing water (w) sup-

plied from the water supply bellows tube 44, and the laundry (m) in the drum 20 is submerged in the washing water (w) introduced thereinto through the through holes 22.

[0048] Thereafter, the driving motor 30 is operated so as to rotate the drum 20, and the laundry (m) in the drum 20 is lifted and then dropped by the lifters 23, thereby being cleaned by the action of the detergent and the water.

[0049] In a water supply or wash mode of the washing machine, the circulating pump 56 is operated so as to pump out the washing water (w) within the filter case 52. The washing water (w) pumped by the circulating pump 56 is guided to the upper portion of the gasket 14 through the circulating hose 60, passes through the through hole 72a of the cylinder 72, and is then dropped.

[0050] The washing water (w) dropped through the through hole 72a of the cylinder 72 collides with the upper surface of the lower sloping portion 77, and is then sprayed onto the lower portion of the rear surface 26 or the circumferential portion 28 of the drum 20, thereby uniformly soaking the laundry (m).

[0051] Generally, the laundry (m) is lifted up to the upper portion of the inside of the drum 20, and is then dropped. However, a part of the laundry (m) is lifted up to a middle portion of the inside of the drum 20 and is then dropped, and the washing water (w) sprayed by the nozzle 72 is directed broadly to the lower portion of the rear surface 26 or the circumferential portion 28 of the drum 20. Therefore, the washing water (w) directly soaks the part of the laundry (m), which is lifted up to the middle portion of the inside of the drum 20 and is then dropped.

[0052] That is, since the washing water (w), which circulates, uniformly soaks all of the laundry (m), the washing machine of the present invention reduces a quantity of the supplied washing water (w) at the same washing capacity and improves washing efficiency at the same quantity of the washing water (w) consumed.

[0053] After the wash mode of the washing machine is finished, contaminated water remains in the lower portion of the tub 10, the drainage bellows tube 48 and the filter case 52. Such contaminated water is discharged to the outside through the drainage hose 55 when the drainage pump 54 is operated.

[0054] Further, the washing machine is operated in a rinse mode, in which clean washing water (w) is supplied into the tub 10 so as to rinse soap bubbles out of the laundry (m). In case that the rinse mode of the washing machine is selected, the washing water (w) supplied from the water supply bellows tube 44 is contained in the lower portion of the tub 10, the drainage bellows tube 48 and the filter case 52, the motor 30 is driven so as to rotate the drum 20 for rinsing the laundry (w), and the laundry (m) in the drum 20 is lifted by the lifters 23 and is then dropped. Thereby, soap bubbles are rinsed out of the laundry (m) by the washing water (w).

[0055] During the water supply or rinse mode of the washing machine, the circulating pump 56 is operated in the same manner as in the wash mode of the washing machine, and the washing water (w) passed through the nozzle 74 is broadly sprayed onto the lower portion of the rear surface 26 or the circumferential portion 28 of the drum 20 at a vertical spraying angle (α) of the lower sloping portion 77 in the range of 30° to 40°, thus uniformly soaking the laundry (m). Accordingly, the washing machine of the present invention reduces a quantity of the supplied washing water (w) at the same rinsing capacity and improves rinsing efficiency at the same quantity of the washing water (w).

[0056] Since the rinsing efficiency is directly proportional to the quantity of the washing water and the square of the number of times of rinse mode, it is preferable to repeat the rinse mode several times using a small quantity of the washing water (w) in order to obtain the same rinsing capacity. Since the washing water (w) sprayed by the nozzle 74 uniformly contacts the laundry (m), the number of times, that the rinse mode is performed, is increased in order to reduce the quantity of the washing water (w) while maintaining the rinsing capacity.

[0057] After the rinse mode of the washing machine is finished, contaminated water remains in the lower portion of the tub 10, the drainage bellows tube 48 and the filter case 52. Such contaminated water is discharged to the outside through the drainage hose 55 when the drainage pump 54 is operated.

[0058] Thereafter, in case that a dehydration mode of the washing machine is selected, the drum 20 is rotated at a high speed so that the laundry (m) is centrifugally dehydrated.

[0059] Fig. 5 is a cross-sectional view of a second embodiment of the nozzle of the washing machine in accordance with the present invention.

[0060] As shown in Fig. 5, the nozzle 74 of this embodiment has a horizontal spraying angle in the range of 110° to 130° so that the sprayed washing water is not spread over sides of the nozzle 74 and is directed concentrically to the inside of the drum 20. Other elements, such as the circulating device, in the second embodiment except for the nozzle 74 are substantially the same as those in the first embodiment and thus denoted by the same reference numerals even though they are depicted in different drawings. Thus, a detailed description of such elements in the second embodiment will be omitted because it is considered to be unnecessary.

[0061] The washing water (w) sprayed by the nozzle 74 tends to gradually get bent inwardly. Preferably, the nozzle 74 has an opened rear surface and an angle between both side surfaces of the nozzle 74 in the range of 130° to 140° in order to obtain the horizontal spraying angle of the nozzle 74 in the range of 110° to 130°.

[0062] The nozzle 74 includes the upper horizontal portion protruded horizontally from the lower end of the cylinder, the front vertical portion 76 protruded perpendicularly from the upper horizontal portion, the lower

sloping portion 77 extended from the lower end of the front vertical portion 76, and side vertical portions 78 and 79 located between both sides of the upper horizontal portion and the lower sloping portion 77 at a horizontal sloping angle in the range of 130° to 140°. The washing water (w) colliding with the upper surface of the lower sloping portion 77 is collected by the side vertical portions 78 and 79, and concentrically sprayed into the drum 20.

[0063] Fig. 6 is a rear view of a third embodiment of the nozzle of the washing machine in accordance with the present invention. Fig. 7 is a partially exploded sectional view of the third embodiment of the nozzle, through which washing water is sprayed into the drum, in accordance with the present invention.

[0064] As shown in Figs. 6 and 7, the nozzle 74 of this embodiment has left and right vertical spraying angles having different degrees. Other elements, such as the circulating device, in the third embodiment except for the nozzle 74 are substantially the same as those in the first or second embodiment and thus denoted by the same reference numerals even though they are depicted in different drawings. Thus, a detailed description of such elements in the third embodiment will be omitted because it is considered to be unnecessary.

[0065] The nozzle 74 includes the upper horizontal portion 75 protruded horizontally from the lower end of the cylinder 72, the front vertical portion 76 protruded perpendicularly from the upper horizontal portion 75, and the lower sloping portion 77 extended from the lower end of the front vertical portion 76 and located to be opposite to the through hole of the cylinder 72. Here, one side of the lower sloping portion 77 has a vertical spraying angle in the range of 5° to 20°, and the other side of the lower sloping portion 77 has a vertical spraying angle in the range of 30° to 50°.

[0066] The washing water collides with the upper surface of the lower sloping portion 77 of the nozzle 74, and is then sprayed from both sides of the lower sloping portion 77 at different vertical spraying angles.

[0067] That is, a part of the washing water guided to one portion 77a, having a larger vertical spraying angle, of the nozzle 74 is sprayed onto the circumferential portion 28 of the drum 20, and the other part of the washing water guided to the other portion 77b, having a smaller vertical spraying angle, of the nozzle 74 is sprayed onto the rear surface 26 of the drum 20.

[0068] Further, it is possible to linearly reduce the vertical spraying angles of the portions 77a and 77b, to reduce the vertical spraying angles of the portions 77a and 77b step by step, or to irregularly arrange the portions 77a and 77b in a horizontal direction.

[0069] Fig. 8 is a cross-sectional view of a fourth embodiment of the nozzle of the washing machine in accordance with the present invention.

[0070] As shown in Fig. 8, the nozzle 74 of this embodiment has horizontal spraying angles ($\gamma 1$, $\gamma 2$) of different degrees. Other elements, such as the circulating device, in the fourth embodiment except for the nozzle 74 are substantially the same as those in the first, second or third embodiment and thus denoted by the same reference numerals even though they are depicted in different drawings. Thus, a detailed description of such elements in the fourth embodiment will be omitted because it is considered to be unnecessary.

[0071] The nozzle 74 includes the upper horizontal portion protruded horizontally from the lower end of the cylinder, the front vertical portion 76 protruded perpendicularly from the upper horizontal portion, the lower sloping portion 77 extended from the lower end of the front vertical portion 76 and located to be opposite to the through hole of the cylinder, and the side vertical portions 78 and 79, located between both sides of the upper horizontal portion and the lower sloping portion 77, having difference horizontal sloping angles. Here, one side of the lower sloping portion 77 has a horizontal spraying angle in the range of 30° to 50°, and the other side of the lower sloping portion 77 has a horizontal spraying angle in the range of 60° to 80°.

[0072] That is, the nozzle 74 has an opened rear surface, and one side vertical portion 78 of the side vertical portions 78 and 79 has a comparatively small horizontal spraying angle (γ_1), thereby allowing washing water, which collides with the lower sloping portion 77 and is guided along the side vertical portion 78, to be directed to the rear surface of the drum. Further, the other side vertical portion 79 of the side vertical portions 78 and 79 has a comparatively large horizontal spraying angle (γ_2), thereby allowing washing water, which collides with the lower sloping portion 77 and is guided along the side vertical portion 79, to be directed to the circumferential portion of the drum.

[0073] As apparent from the above description, the washing machine of the present invention has advantages as follows.

[0074] First, the washing machine comprises a nozzle having a vertical spraying angle in the range of 30° to 40° so that washing water sprayed from the nozzle is directed to a lower portion of a rear surface or a circumferential portion of a drum and uniformly directed to laundry in the drum, thereby improving washing and rinsing efficiency and reducing a quantity of the washing water consumed.

[0075] Second, a washing machine comprises a nozzle having a horizontal spraying angle in the range of 110° to 130° so that washing water sprayed from the nozzle is concentrically directed to the drum in order to minimize washing water leakage through a gap between the drum and the tub, thereby improving washing and rinsing efficiency and reducing a quantity of the washing water consumed.

[0076] Third, a washing machine comprises a nozzle having different left and right vertical spraying angles so that a part of washing water guided to a portion of the nozzle having a comparatively small vertical spraying angle is directed to a rear surface of a drum and the part

of washing water guided to a portion of the nozzle having a comparatively large vertical spraying angle is directed to a circumferential portion of the drum, thus allowing the washing water to be uniformly directed to laundry in the drum, thereby improving washing and rinsing efficiency and reducing a quantity of the washing water consumed.

[0077] Fourth, a washing machine comprises a nozzle having different left and right horizontal spraying angles so that a part of washing water guided to a portion of the nozzle having a comparatively small horizontal spraying angle is directed to a rear surface of a drum and the part of washing water guided to a portion having a comparatively large horizontal spraying angle is directed to a circumferential portion of the drum, thus allowing the washing water to be uniformly directed to laundry in the drum, thereby improving washing and rinsing efficiency and reducing a quantity of the washing water consumed.

[0078] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A washing machine comprising a tub(10) for containing washing water(w), a drum(20) rotatably arranged in the tub(10) for accommodating laundry (m), a motor(30) for rotating the drum(20), and a washing water-circulating device for circulating the washing water(w) so that the washing water(w) in the tub(10) is sprayed into the drum(20),

wherein the washing water-circulating device includes a nozzle(74) having a vertical water-spraying angle ($\alpha°$) in the range of 30° to 40°.

2. The washing machine as set forth in claim 1,

wherein the washing water-circulating device further includes a cylinder(72) installed on a gasket (14) arranged in front of the tub(10) and provided with a through hole(72a) for passing the circulated washing water(w).

3. The washing machine as set forth in claim 2, wherein the washing water-circulating device includes:

a drainage bellows tube(48) having one end connected to a drainage hole(15) formed in the tub(10) for guiding the washing water(w) in the tub(10);

a circulating pump(56) to which the other end of the drainage bellows tube(48) is connected for pumping the guided washing water(w); and

a circulating hose(60) having one end connected to the circulating pump(56) and the other end connected to the cylinder(72) for guiding the pumped washing water(w) to the cylinder (72).

4. The washing machine as set forth in claim 2,

wherein the through hole(72a) of the cylinder (72) has a diameter, which is 0.4 to 0.65 times as large as the diameter of the nozzle(74).

5. The washing machine as set forth in claim 2, wherein the nozzle(74) includes:

an upper horizontal portion(75) protruded horizontally from a lower end of the cylinder(72);

a front vertical portion(76) protruded perpendicularly from the upper horizontal portion(75); and

a lower sloping portion(77) extended from a lower end of the front vertical portion(76) at a vertical sloping angle in the range of 30° to 40° and arranged opposite to the through hole (72a).

6. The washing machine as set forth in claim 5,

wherein a central part of the lower sloping portion(77) is spaced from a lower end of the through hole(72a) by a distance of 2mm to 4mm.

7. The washing machine as set forth in claim 5,

wherein the lower sloping portion(770 has a length of 20mm to 25mm.

8. A washing machine comprising a tub(10) for containing washing water(w), a drum(20) rotatably arranged in the tub(10) for accommodating laundry (m), a motor(30) for rotating the drum(20), and a washing water-circulating device for circulating the washing water(w) so that the washing water(w) in the tub(10) is sprayed into the drum(20),

wherein the washing water-circulating device includes a nozzle(74) having a horizontal water-spraying angle ($\beta°$) in the range of 110° to 130°.

9. The washing machine as set forth in claim 8,

wherein the nozzle(74) has an opened rear surface and an angle between both side surfaces (78,79) thereof in the range of 130° to 140°.

10. The washing machine as set forth in claim 8,

wherein the washing water-circulating device further includes a cylinder(72) installed on a gasket (14) arranged in front of the tub(10) and provided with a through hole(72a) for passing the circulated washing water(w).

11. The washing machine as set forth in claim 10, wherein the washing water-circulating device in-

cludes:

a drainage bellows tube(48) having one end connected to a drainage hole(15) formed in the tub(10) for guiding the washing water(w) in the tub(10);
a circulating pump(56) to which the other end of the drainage bellows tube(48) is connected for pumping the guided washing water(w); and
a circulating hose (60) having one end connected to the circulating pump(56) and the other end connected to the cylinder(72) for guiding the pumped washing water(w) to the cylinder (72).

12. The washing machine as set forth in claim 10, wherein the nozzle(74) includes:

an upper horizontal portion(75) protruded horizontally from a lower end of the cylinder(72);
a front vertical portion(76) protruded perpendicularly from the upper horizontal portion(75);
a lower sloping portion(77) extended from a lower end of the front vertical portion(76) and located to be opposite to the through hole(72a) of the cylinder(72); and
side vertical portions (78, 79) located between both sides of the upper horizontal portion(75) and the lower sloping portion(77) at a horizontal sloping angle in the range of 130° to 140°.

13. A washing machine comprising a tub(10) for containing washing water(w), a drum(20) rotatably arranged in the tub(10) for accommodating laundry (m), a motor(30) for rotating the drum(20), and a washing water-circulating device for circulating the washing water(w) so that the washing water(w) in the tub(10) is sprayed into the drum(20)

wherein the washing water-circulating device includes a nozzle(74) having different right and left vertical water-spraying angles.

14. The washing machine as set forth in claim 13,

wherein one angle of the right and left vertical water-spraying angles of the nozzle(74) is in the range of 5° to 20°, and the other angle of the right and left vertical water-spraying angles of the nozzle (74) is in the range of 30° to 50°.

15. The washing machine as set forth in claim 13,

wherein the washing water-circulating device further includes a cylinder(72) installed on a gasket (14) arranged in front of the tub(10) and provided with a through hole(72a) for passing the circulated washing water(w).

16. The washing machine as set forth in claim 15, wherein the washing water-circulating device in-

cludes:

a drainage bellows tube(48) having one end connected to a drainage hole(15) formed in the tub(10) for guiding the washing water(w) in the tub(10);
a circulating pump(56) to which the other end of the drainage bellows tube(48) is connected for pumping the guided washing water(w); and
a circulating hose (60) having one end connected to the circulating pump(56) and the other end connected to the cylinder(72) for guiding the pumped washing, water(w) to the cylinder (72).

17. The washing machine as set forth in claim 15, wherein the nozzle(74) includes:

an upper horizontal portion(75) protruded horizontally from a lower end of the cylinder(72);
a front vertical portion(76) protruded perpendicularly from the upper horizontal portion(75); and
a lower sloping portion(77) extended from a lower end of the front vertical portion(76), located to be opposite to the through hole(72a) of the cylinder(72), and having one vertical water-spraying angle in the range of 5° to 20° and the other vertical water-spraying angle in the range of 30° to 50°.

18. A washing machine comprising a tub(10) for containing washing water(w), a drum(20) rotatably arranged in the tub(10) for accommodating laundry (m), a motor(30) for rotating the drum(20), and a washing water-circulating device for circulating the washing water(w) so that the washing water(w) in the tub(10) is sprayed into the drum(20),

wherein the washing water-circulating device includes a nozzle(74) having different right and left horizontal water-spraying angles (r_1°, r_2°)

19. The washing machine as set forth in claim 18,

wherein one angle (r_1°) of the right and left horizontal water-spraying angles of the nozzle(74) is in the range of 30° to 50°, and the other angle (r_2°) of the right and left horizontal water-spraying angles of the nozzle(74) is in the range of 60° to 80°.

20. The washing machine as set forth in claim 18,

wherein the washing water-circulating device further includes a cylinder(72) installed on a gasket (14) arranged in front of the tub(10) and provided with a through hole(72a) for passing the circulated washing water(w).

21. The washing machine as set forth in claim 20, wherein the washing water-circulating device in-

cludes:

a drainage bellows tube(48) having one end connected to a drainage hole(15) formed in the tub(10) for guiding the washing water(w) in the tub(10);
a circulating pump(56) to which the other end of the drainage bellows tube(48) is connected for pumping the guided washing water(w); and
a circulating hose(60) having one end connected to the circulating pump(56) and the other end connected to the cylinder(72) for guiding the pumped washing water(w) to the cylinder (72).

22. The washing machine as set forth in claim 20, wherein the nozzle(74) includes:

an upper horizontal portion(75) protruded horizontally from a lower end of the cylinder(72);
a front vertical portion(76) protruded perpendicularly from the upper horizontal portion(75); and
a lower sloping portion(77) extended from a lower end of the front vertical portion(76), located to be opposite to the through hole(72a) of the cylinder(72), and having one horizontal water-spraying angle (r_1°) in the range of 30° to 50° and the other horizontal water-spraying angle (r_2°) in the range of 60° to 80°.

FIG. 1

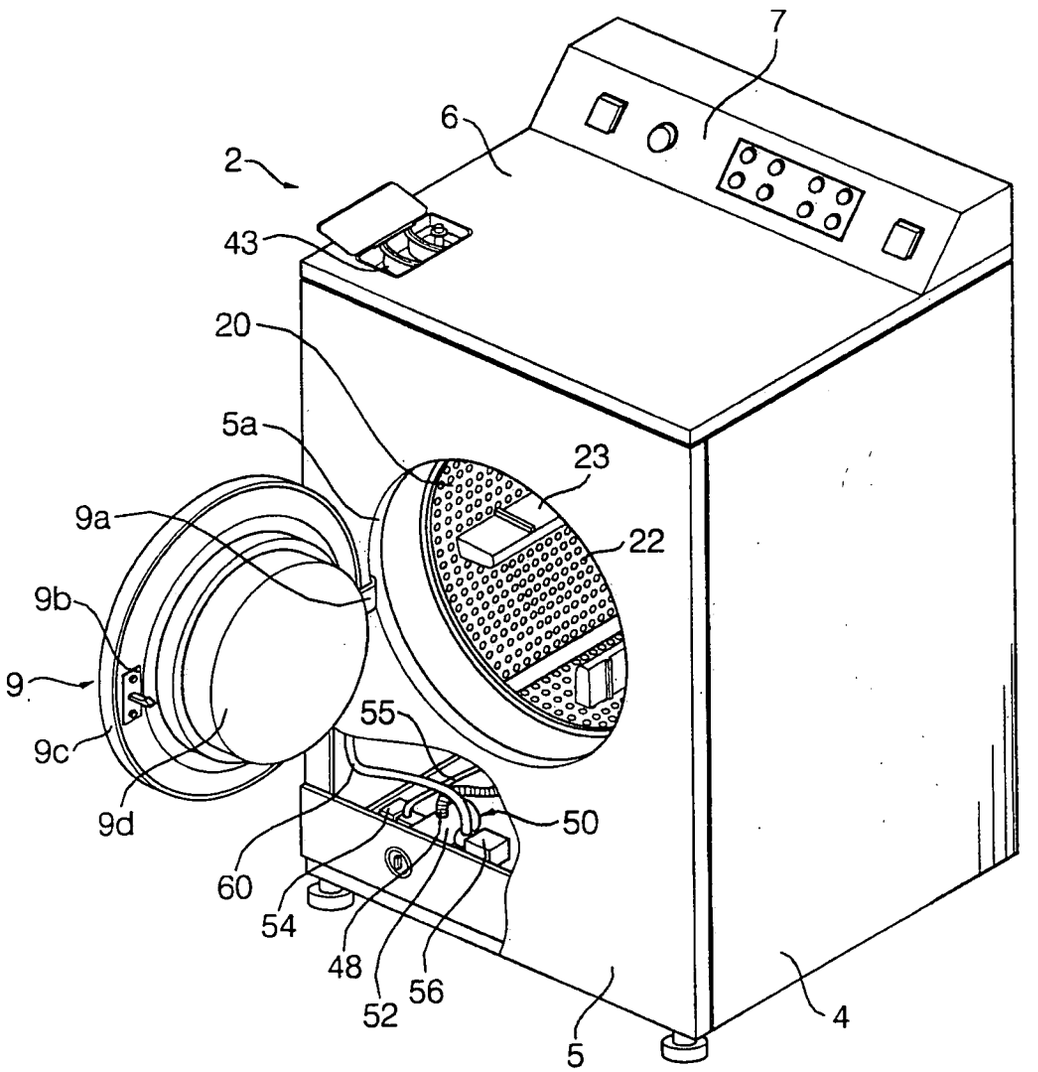


FIG. 2

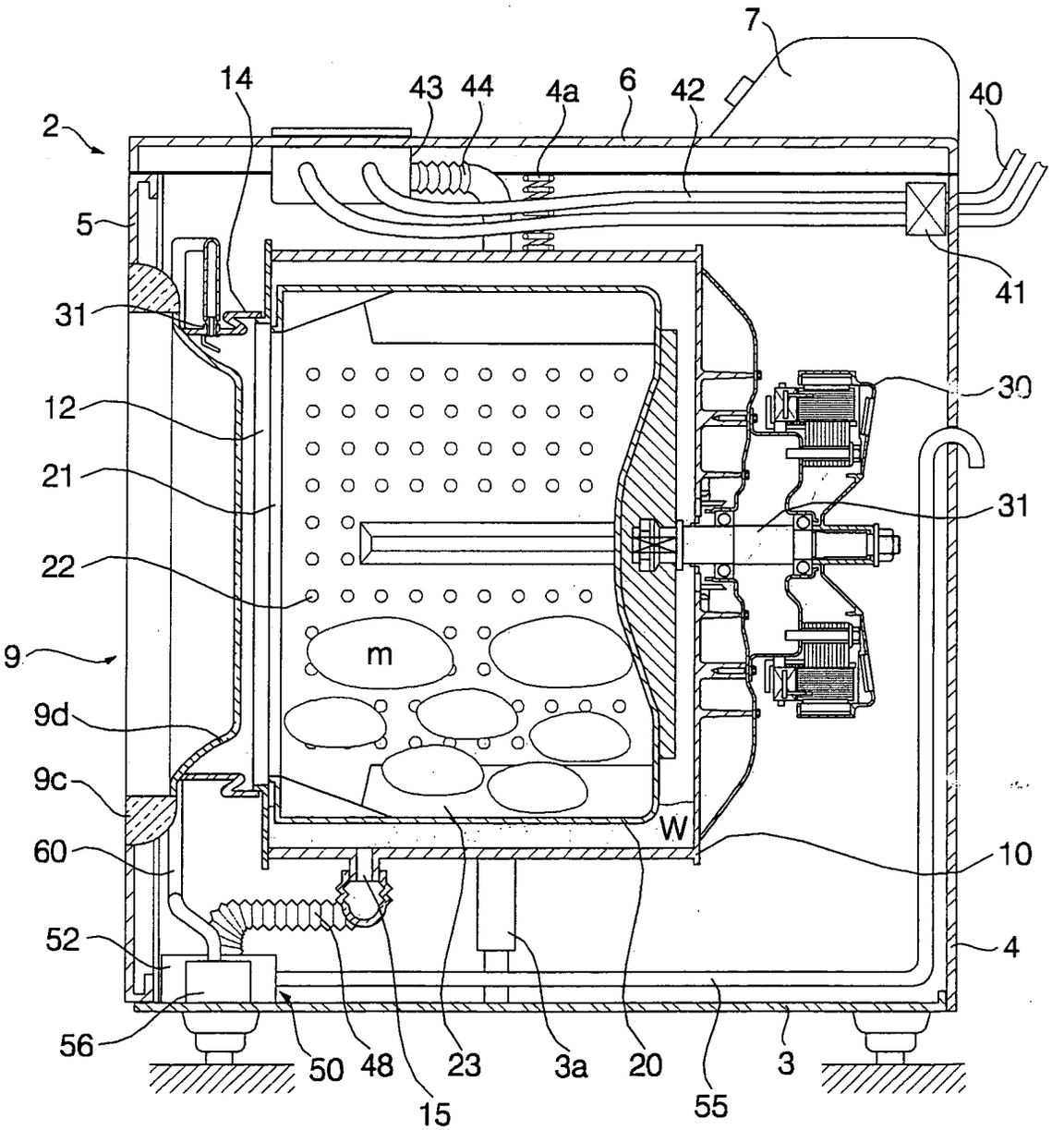

7
14
43
44
4a
6
42
40
2
5
41
31
30
12
21
31
22
m
9
9d
9c
W
10
60
52
4
56
50
48
23
3a
20
3
15
55

FIG. 3

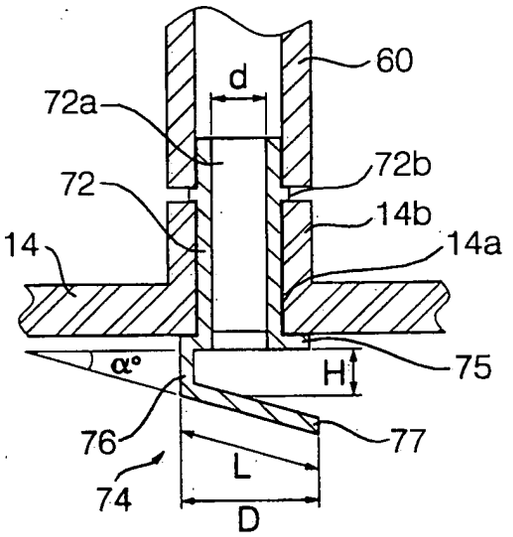


FIG. 4

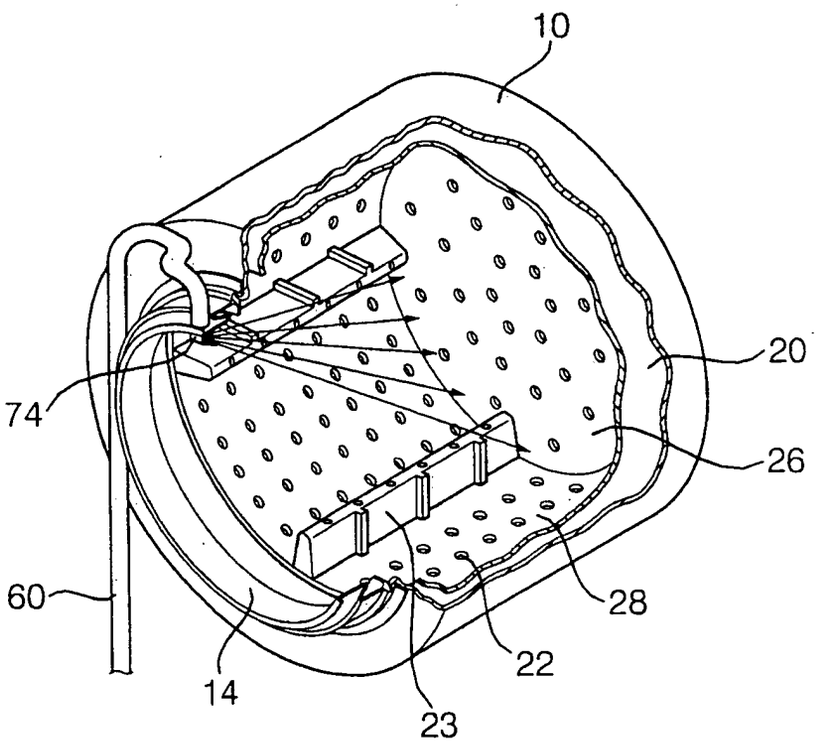


FIG. 5

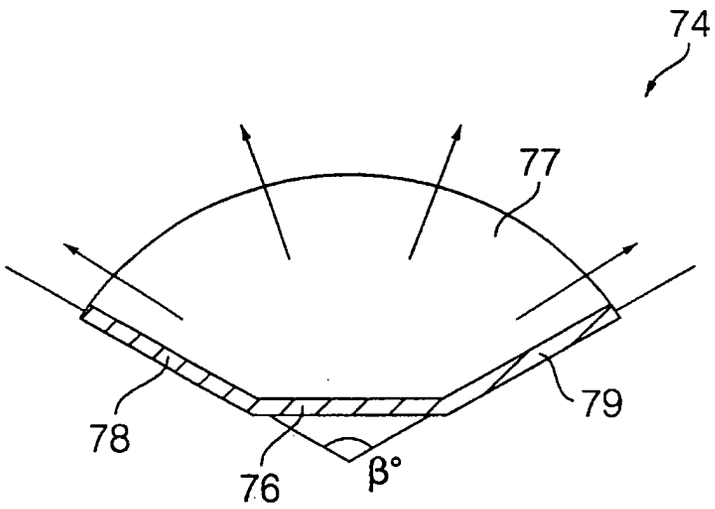


FIG. 6

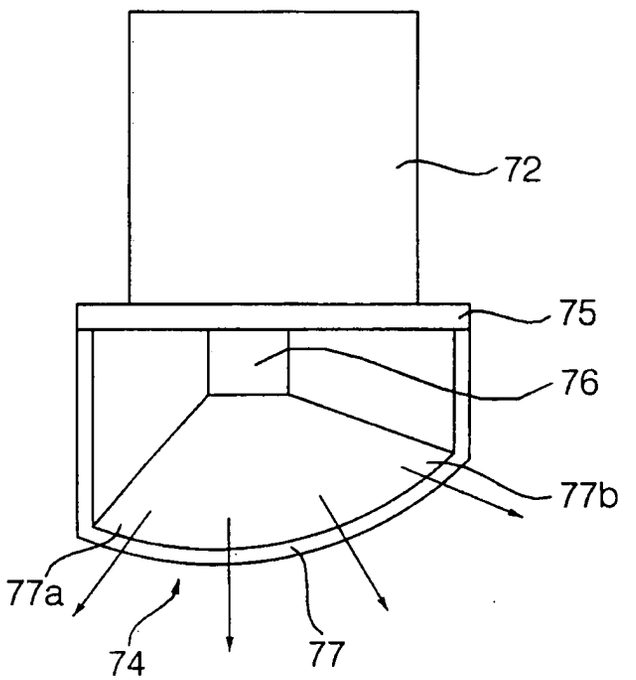


FIG. 7

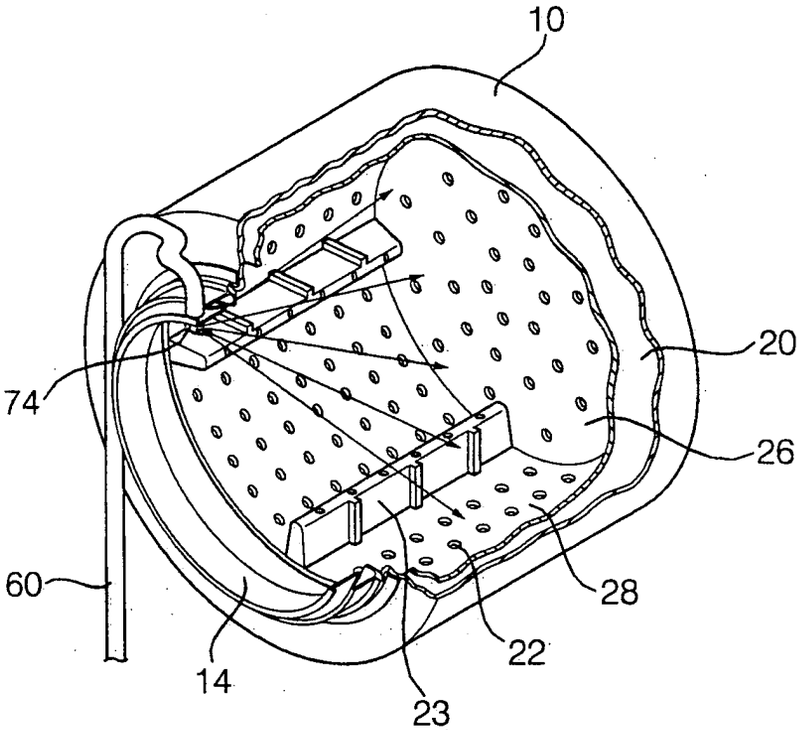
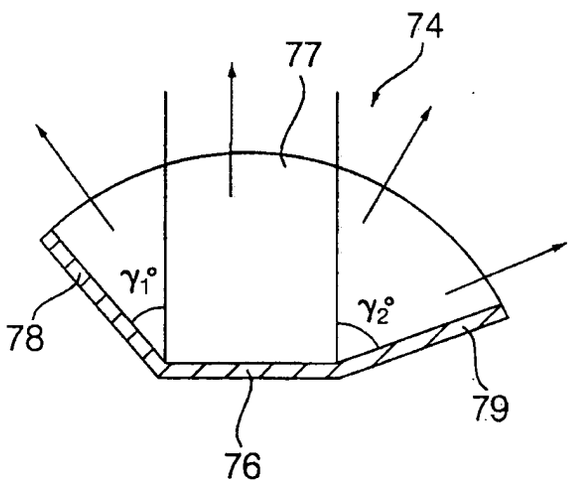


FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 1677

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A	DE 43 30 079 A (BOSCH SIEMENS HAUSGERAETE) 9 March 1995 (1995-03-09) * column 2, lines 17-56; figures 1-3 *	1-22	
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P,A	EP 1 386 996 A (LG ELECTRONICS INC) 4 February 2004 (2004-02-04) * paragraphs [0015] - [0018] * * paragraphs [0040] - [0050] * * paragraphs [0065], [0066], [0072] * * figures 1-6 *	1-22	

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D06F
B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 November 2004	Weinberg, E

CATEGORY OF CITED DOCUMENTS

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