



(11) **EP 1 500 736 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
06.04.2016 Bulletin 2016/14

(51) Int Cl.:
D06F 23/06 ^(2006.01) **D06F 37/04** ^(2006.01)
D06F 39/08 ^(2006.01)

(21) Application number: **04250111.4**

(22) Date of filing: **12.01.2004**

(54) **Washing machine**

Waschmaschine

Machine à laver

(84) Designated Contracting States:
DE GB IT

(30) Priority: **23.07.2003 KR 2003050656**

(43) Date of publication of application:
26.01.2005 Bulletin 2005/04

(73) Proprietor: **Samsung Electronics Co., Ltd.**
Suwon-si, Gyeonggi-do, 443-742 (KR)

(72) Inventors:

- **Park, Jae-Ryong**
Youngtong-Gu
Suwon-Si
Gyeonggi-Do (KR)
- **Kim, Hyung-Gyoon**
Paldal-Gu
Suwon-City
Kyungki-do (KR)
- **Pyo, Sang-Yeon**
Suwon-City
Kyungko-do (KR)
- **Park, Seon-Woo**
Suwon-City
Kyungki-do (KR)
- **Yang, Hye Soon**
Yongin-City
Kyungki-do (KR)

- **Oak, Seong Min**
Masan-City
Kyungsangnam-Do (KR)
- **Yang, Byoung Yull**
Ansan-City
Kyungki-do (KR)
- **Kim, Hyun Sook**
Suwon-City
Kyungki-do (KR)

(74) Representative: **Grey, Ian Michael et al**
Venner Shipley LLP
200 Aldersgate
London EC1A 4HD (GB)

(56) References cited:

EP-A- 0 421 442	EP-A- 0 597 513
DE-A- 2 826 506	GB-A- 725 991
GB-A- 1 452 531	US-A- 3 385 085
US-A- 6 065 312	US-B2- 6 553 594

- **PATENT ABSTRACTS OF JAPAN vol. 2000, no. 23, 10 February 2001 (2001-02-10) & JP 2001 149685 A (TOSHIBA CORP), 5 June 2001 (2001-06-05)**

EP 1 500 736 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a drum washing machine including a tub and rotatably mounted drum within the tub to receive laundry to be washed, the drum having first and second end parts spaced from each other by a cylindrical sidewall part.

[0002] A conventional drum washing machine comprises a cylindrical rotary drum which is rotatably mounted in a water tub within a housing and is rotated to agitate laundry in water to wash the laundry. An example of a conventional drum washing machine is disclosed in Japanese patent laid-open Publication No. 2001-149685.

[0003] A conventional drum washing machine includes a rotary water drum, a tub and a heater. The tub contains water therein and the rotary drum has a plurality of perforations in its sidewall. The heater is installed at a predetermined position under the tub so as to heat water to a predetermined temperature. When the drum washing machine is operating and both water and detergent are fed into the tub, the drum is rotated in the tub at a low speed. During a wash cycle, the heater heats water to a predetermined temperature, thereby enhancing the washing effect of the washing machine.

[0004] A conventional drum washing machine suffers from several problems. Firstly, it is necessary to feed water into the washing machine to a level at which the laundry inside the drum is immersed in the water also allowing for a gap between the perforated rotary drum and the tub. Therefore, a conventional drum washing machine consumes an excessive amount of water. Since a conventional drum washing machine is designed so that water is fed into the tub and flows into the rotary drum through the perforations until the laundry in the rotary drum is immersed in the water, a large amount of water must be fed into the tub. Consumption of the water during the operation of the washing machine is thus excessively increased, leading to an increase in cost.

[0005] As an excessive amount of water is consumed, a long period of time for feeding or draining water into or from the tub is required. In addition, the washing time is further increased as water must be heated to a predetermined temperature by the heater, before the rotary drum starts to rotate to wash the laundry in the heater water. Furthermore, since the large amount of water must be heated to the predetermined temperature by the heater, an excessive amount of electricity is used to heat the water.

[0006] Another disadvantage is that it is difficult to manufacture the drum as perforations must be formed around its sidewall to allow the water to flow between the tub and the rotary drum and to allow the rotary drum to spin-dry the laundry during a spin-drying operation.

[0007] Washing machines known in the prior art are disclosed in e.g. US 6,553,594 or US 6,065,312.

[0008] A washing machine according to a first aspect of the present invention is characterised in that the drum is mounted for rotation about an axis inclined relative to

the horizontal so that the sidewall part is angled downwardly away from the second end part, the first end part and the sidewall part being completely closed to contain water in the drum and a plurality of drain holes being formed in the second end part, to allow water to collect in the drum in a region between the sidewall part and the first end part, beneath the drain holes.

[0009] A washing machine according to a second aspect of the present invention is characterised in that the drum is mounted for rotation about an axis inclined relative to the horizontal so that the sidewall part is angled downwardly away from the second end part, wherein a plurality of drain holes is formed in the second end part, the first end part and the sidewall part being completely closed to contain water in the drum with the exception of additional drain holes being formed around the edge of the sidewall part adjacent to the second end part, to allow water to collect in the drum in a region between the sidewall part and the first end part, beneath the drain holes. In a preferred embodiment, the angle of inclination of the sidewall part relative to the horizontal is different to the angle of inclination of the axis about which the tub rotates so that when the tub rotates, water contained therein is directed toward the drain holes.

[0010] Preferably, the angle of inclination of the sidewall part relative to the horizontal is less than the angle of inclination of the axis of rotation of the tub relative to the horizontal.

[0011] Conveniently, the plurality of drain holes are arranged in a circular pattern in the second end part.

[0012] Alternatively, the plurality of drain holes in the second end part are arranged in a first circular pattern and at least one further circular pattern concentric with the first circular pattern.

[0013] In another embodiment, the junction between said second end part and the sidewall part is curved and the drain holes are formed in the curved region.

[0014] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a sectional view of a drum washing machine according to an embodiment of the present invention during a wash cycle;

Figure 2 is a sectional view of the drum washing machine in Figure 1 during a spin-drying cycle;

Figure 3 is a sectional view taken along a line of III-III' of Figure 1;

Figure 4 is a perspective view of a rotary drum included in the drum washing machine of Figure 1;

Figure 5 is a sectional view of the rotary drum of Figure 4; and

Figures 6 and 7 are sectional views of a rotary drum with drain holes provided on the rotary drum according to a first modification and a second modification of the embodiment of Figure 1 respectively.

[0015] As shown in Figure 1, a drum washing machine

according to the present invention includes a housing 10, a tub 11, and a rotary drum 20. The tub 11 is installed in the housing 10 and receives water therein for washing. The rotary drum 20 is rotatably mounted within the tub 11.

[0016] In the housing 10, the axis of the tub 11 is inclined relative to the horizontal at a predetermined first angle α of inclination, such that a front part 11a of the tub 11 having an inlet opening 11b is at a position higher than a rear part 11c of the tub 11. In the same manner as the tub 11, the drum 20 is mounted in the tub 11 such that a front part 22 of the rotary drum 20 having an inlet opening 23 is placed at a position higher than a rear part 21 of the rotary drum 20. That is, a rotating axis A of the rotary drum 20 is inclined relative to a horizontal axis at the first angle α of inclination to allow the front part 22 having the inlet opening 23 to be placed at the position higher than the rear part 21. A rotating shaft 12, which is securely mounted to a centre of the rear part 21 of the rotary drum 20, is rotatably held in a centre of the rear part 11c of the tub 11, thus allowing the drum 20 to rotate relative to the tub 11. The tub 11 is suspended in the housing 10 by a plurality of shock absorbing suspension units (not shown) while being apart from an internal surface of the housing 10. The axis of rotation of the rotary drum 20 is coaxial with the axis of the tub 11.

[0017] A motor 13 to rotate the rotating shaft 12 of the drum 20 is mounted outside the rear part 11c of the tub 11 and includes a stator 13a mounted to the rear part 11c of the tub 11, a rotor 13b which is rotatably placed around the stator 13a, and a rotary disc 13c which couples the rotor 13b to the stator 13a.

[0018] The front of the housing 10 has an inlet opening 14 which is aligned with both the inlet opening 11b of the tub 11 and the inlet opening 23 of the rotary drum 20, to enable a user to put laundry into, or remove it from, the rotary drum 20 via the three aligned inlet openings 14, 23 and 11b. A door 15 is hingedly mounted to an edge of the inlet opening 14 so as to close the opening 14. To prevent leakage of wash water from the tub 11, a cylindrical bellows 16 extends between the inlet opening 14 of the housing 10 and the inlet opening 11b of the tub 11. A cylindrical guide unit 17 is placed inside the bellows 16 to allow the user to easily put or remove laundry into or from the rotary drum 20.

[0019] A detergent supply unit 18 and a water supply unit 30 are installed in the housing 10 at positions above the water tub 11 to respectively feed detergent and water into the tub 11. The detergent supply unit 18 is placed at the front part of the housing 10 to allow the user to fill it with detergent. The water supply unit 30 comprises a first water feed pipe 32 which extends from an external water supply pipe 31 to the detergent supply unit 18, a second water feed pipe 33 which extends from the detergent supply unit 18 to the tub 11, and a first control valve 34 which is mounted to an intermediate portion of the first water feed pipe 32 to control a flow of the water to be fed into the tub 11. Due to coupled construction of the detergent supply unit 18 and the water supply unit 30, the water

passes through the detergent supply unit 18, prior to reaching the tub 11. Therefore, the detergent contained in the detergent supply unit 18 is dissolved in water prior to being fed into the tub 11.

[0020] The drum washing machine has a heater 40 in a lower portion of the tub 11 to heat water contained in the tub 11. A heater holding part 41, which is a pan-shaped part, is provided at a lower portion of a sidewall of the tub 11 by drawing or deflecting the lower portion of the sidewall of the tub 11 downward, away from the rotary drum, as shown in Figures 1, 2 and 3. The heater 40 is installed in the heater holding part 41 in which a predetermined amount of water is collected so that the heater 40 is submerged in water. Since the heater 40 is placed in the heater holding part 41 the rotary drum 20 can rotate without interfering with the heater 40.

[0021] The drum washing machine also has a drain unit 50 which discharges water from the tub 11 and a water circulation unit 60 which feeds water, which is heated by the heater 40 in the tub 11, into the rotary drum 20. The drain unit 50 comprises a first drain pipe 51, a drain pump 52 and a second drain pipe 53. The first drain pipe 51 is connected to a drain port 42 in communication with the heater holding part 41 of the lower portion of the tub 11 to allow water to be discharged from the tub 11. The drain pump 52 is mounted to an intermediate portion of the first drain pipe 51 and the second drain pipe 53 extends from an outlet of the drain pump 52. The water circulation unit 60 includes a second control valve 61, a water circulation pipe 62, and a spray nozzle 63. The second control valve 61 is mounted to an intermediate portion of the second drain pipe 53 that extends from the outlet of the drain pump 52. The water circulation pipe 62 extends from the second control valve 61 to the inlet opening 23 of the rotary drum 20. The spray nozzle 63 is mounted to an outlet of the water circulation pipe 62. The second control valve 61 controls a flow direction of the wash water flowing from the outlet of the drain pump 52 so as to drain discharged wash water or to guide discharged wash water into the water circulation pipe 62. A motorized three-way valve may be used as the second control valve 61. The spray nozzle 63 is held by the guide unit 17 adjacent to the inlet opening 23 of the rotary drum 20, thus spraying wash water into the rotary drum 20 through the inlet opening 23. Due to the above-described coupled construction of the drain unit 50 and the water circulation unit 60, the water which is discharged from the lower portion of the water tub 11 may be drained to the outside of the housing 10 or be sprayed into the rotary drum 20. That is, when the drain pump 52 is operated with the second control valve 61 controlled to guide the discharged water to the water circulation pipe 62, as shown in Figure 1, the discharged water passes through both the first drain pipe 51 and the water circulation pipe 62 to be sprayed into the rotary drum 20. However, when the drain pump 52 is operated with the second control valve 61 controlled to guide the discharged water to the second drain pipe 53, as shown in Figure 2, the dis-

charged water is drained to the outside of the housing 10.

[0022] As shown in Figures 4 and 5, the rotary drum 20, which is installed in the water tub 11 to be inclined relative to the horizontal axis of the cabinet 10 at the first angle α of inclination, comprises the front part 22 having the inlet opening 23, the rear part 21 securely coupled to the rotating shaft 12, and a cylindrical sidewall part 24 extending between the front part 22 and the rear part 21. The rear part 21 and the cylindrical sidewall part 24 are completely closed to contain water in the drum 20. The diameter of the rotary drum 20 gradually increases from the rear part 21 to the front part 22 so that the sidewall part 24 of the rotary drum 20 is inclined at an angle β relative to the rotating axis A of the rotary drum 20 as shown in Figure 5. A plurality of drain holes 25 are provided along an edge of the inlet opening 23 of the front part 22 to discharge water from the rotary drum 20 when it is rotated at a high speed. As shown in Figure 3, the rotary drum 20 also has a plurality of lifters 26 around an internal surface of the cylindrical sidewall part 24 to repeatedly lift the laundry upward along with the water so that it drops from the top to the bottom inside the rotary drum 20 due to gravity, when the rotary drum 20 rotates. To enhance the washing effect of the drum washing machine, a plurality of agitating blades 27 are provided on an internal surface of the rear part 21 of the rotary drum 20 as shown in Figure 3.

[0023] As the axis A of the rotary drum 20 is inclined relative to the horizontal axis of the housing 10 at the first angle α of inclination, a predetermined amount of water is contained in the rotary drum 20 to allow the laundry to be submerged in the water. The water is fed into the rotary drum 20 to reach a level that is not higher than a lowermost drain hole 25 of the rotary drum 20. The first angle α of inclination of the rotating axis A of the rotary drum 20 relative to the horizontal axis of the housing 10 may be set to approximately 15° in order to contain an appropriate amount of water in the rotary drum 20 and effectively wash the laundry.

[0024] As described above, the sidewall 24 of the rotary drum 20 is inclined relative to the rotating axis A of the rotary drum 20 at the second angle β of inclination, and the drain holes 25 are provided along the edge of the inlet opening 23 of the front part 22 of the rotary drum 20. As a result, water is guided to the drain holes 25 of the rotary drum 20 during rotation of the rotary drum 20. That is, when the rotary drum 20 is rotated at a high speed during a spin-drying operation of the washing machine, water is squeezed out of the laundry in the rotary drum 20 and moves in a radial direction away from the axis A due to centrifugal force. Due to the angle of inclination β of the sidewall 24 relative to the axis A, the water is guided to the drain holes 25 along the inclined internal surface of the cylindrical sidewall part 24, prior to being discharged to the outside of the rotary drum 20. To allow smooth discharge of water from the rotary drum, the second angle β of inclination of the internal surface of the rotary drum 20 relative to the rotating axis A of the rotary

drum 20 may be set at 0.5° or higher.

[0025] Figures 6 and 7 are sectional views of a rotary drum 20, with drain holes provided on the rotary drum 20 according to a first modification and a second modification of the embodiment of Figure 1, respectively. In the first modification of Figure 6, a plurality of rows of drain holes 25a are provided on the front part 22 of the rotary drum 20 along the edge of the inlet opening 23 and drain holes 25b are provided around an edge of the cylindrical sidewall part 24 adjacent to the front part 22. due to the drain holes 25a,25b, the rotary drum 20 of Figure 6 more effectively discharges water in comparison with the rotary drum 20 of Figure 4.

[0026] In the second modification of Figure 7, the rotary drum 20 is rounded along a junction corner 28 between the front part 22 and the cylindrical sidewall part 24, with a plurality of drain holes 25c being formed along the rounded junction corner 28. Although this arrangement reduces the water draining effect, in comparison with the rotary drum 20 of Figure 6, it may desirably contain a large amount of water therein, without enlarging the angle α of inclination of the rotary drum 20 relative to the horizontal axis of the housing 10.

[0027] The drum washing machine having the above mentioned construction is operated as follows.

[0028] To execute a wash cycle, the washing machine is turned on after laundry is put into the rotary drum 20 and detergent is added to the detergent supply unit 18 so that the first control valve 34 of the water supply unit 30 opens to feed water into the water tub 11. When water is fed into the water tub 11, the water passes through the detergent supply unit 18 prior to reaching the water tub 11, so that the detergent is dissolved in the water. After a predetermined amount of water is fed into the water tub 11, the supply of water into the water tub 11 is stopped. Since both the rear part 21 and the cylindrical sidewall part 24 of the rotary drum 20 as well as the junction between the rear part 21 and the sidewall part 24 are completely closed, water cannot enter the rotary drum 20 during supply of the water into the tub 11, but remains in the heater holding part 41 at the lower portion of the sidewall of the water tub 11. In addition, since it is not necessary to feed water into the tub 11 to a level allowing the laundry in the rotary drum 20 to be submerged in water, as in the conventional drum washing machine, the amount of water required to wash the laundry is substantially reduced.

[0029] When the predetermined amount of water is completely fed into the water tub 11, the heater 40 is turned on to heat the water. Since the amount of water contained in the tub 11 is reduced, in comparison to the conventional drum washing machine, as described above, it is possible to quickly heat the water within a short period, thereby shortening the washing time and reducing an amount of electricity required to heat the water.

[0030] After the water in the tub 11 is completely heated by the heater 40 to a predetermined temperature, the

control valve 61 of the water circulation unit 60 is operated to permit the outlet of the drain pump 52 to communicate with the water circulation pipe 62. When the drain pump 52 in the above state is operated, the heater water is discharged from the heater holding part 41 to pass through both the first drain pipe 51 and the water circulation pipe 62, thus being fed into the rotary drum 20. In the above state, an entire part of the laundry contained in the rotary drum 20 is uniformly wet with the water since the spray nozzle 63 sprays the water onto the laundry. The rotary drum 20 is rotated at a low speed by the motor 13 simultaneously with the spraying of the water into the rotary drum 20, thus washing the laundry.

[0031] During the wash cycle, the entire laundry contained in the rotary drum 20 is sufficiently wet with the water contained in the rotary drum 20 since the rotary drum 20 is installed in the housing 10 and inclined relative to the horizontal axis of the housing 10 at the first angle α of inclination, as shown in Figure 1. The drum washing machine thus smoothly and effectively executes the wash cycle. When the level of water in the rotary drum 20 exceeds the height of a lowermost drain hole 25 of the rotary drum 20 water overflows from the rotary drum 20 into the tub 11 through the drain holes 25, prior to returning from the tub 11 to the drum 20 by an operation of the drain pump 52. The circulation of water is continued during the wash cycle. When the drum washing machine performs the wash cycle, most of the water is continuously fed from the tub 11 into the drum 20, so that the tub 11 contains only a small amount of water therein.

[0032] When the wash cycle is finished, the drum washing machine executes a rise cycle to repeatedly rinse and spin-dry the washed laundry. To execute the rinse cycle, the washed laundry must be primarily spin-dried. To spin-dry the washed laundry, the drain pump 52 is operated with the second control valve 61 controlled to permit the outlet of the drain pump 52 to communicate with the second drain pipe 53, and the rotary drum 20 is rotated at a high speed, thus spin-drying the washed laundry. While the rotary drum 20 is rotated at a high speed to spin-dry the laundry, the water is primarily squeezed out of the laundry in the rotary drum 20 and moves in a radially outward direction along the internal surface of the cylindrical sidewall part 24 of the rotary drum 20 due to a centrifugal force, and is secondarily guided to the drain holes 25, since the internal surface of the rotary drum 20 is inclined relative to the rotating axis A of the rotary drum 20 at the second angle β of inclination, as shown in Figure 2. The water in the drum 20 is thus discharged to the outside of the rotary drum 20 through the drain holes 25, and the water in the tub 11 is drained to the outside of the housing 10 by the operation of the drain pump 52. After spin-drying the washed laundry, new water enters the tub 11 by the operation of the water supply unit 30, and is introduced into the drum 20 by the operation of the water circulation unit 60, in the same manner as that described for the wash cycle, thus rinsing laundry. During the rinse cycle, the

spin-drying of the laundry and the feeding of new water into the water tub 11 are repeated several times.

[0033] The rinse cycle ends with a final spin-drying of the rinsed laundry. To finally spin-dry the rinsed laundry, the drain pump 52 is operated with the second control valve 61 controlled to permit the outlet of the drain pump 52 to communicate with the second drain pipe 53, and the rotary drum 20 is rotated at a high speed for a predetermined period of time. That is, the final spin-drying of the rinsed laundry is performed in the same manner as an intermediate spin-drying of the laundry during the rinsing operation.

[0034] The present invention provides a drum washing machine in which a rotary drum is installed in a housing and is inclined relative to a horizontal axis of the housing, and both a rear part and a sidewall part of the rotary drum as well as a junction between the rear part and the sidewall part are completely closed. Water is contained in the rotary drum during a washing operation of the drum washing machine. Therefore, the drum washing machine uses less water to wash laundry, without reducing the washing effect as in a conventional drum washing machine.

[0035] In addition, the drum washing machine feeds a small amount of water from a water tub into the rotary drum after heating the small amount of water by use of a heater, thus reducing the amount of electricity required to heat the water, and reducing washing time. As the drum washing machine uses less water to wash laundry, the washing machine quickly feeds and drains the water into and from the tub, thus reducing the overall washing time.

[0036] Since the drum washing machine washes laundry using less water, the washing machine drains less water, thus reducing the amount of wastewater to cause environmental pollution.

[0037] Furthermore, as the rotary drum does not have perforations on the rear or sidewall part thereof, it has a simple construction.

[0038] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles of the invention, the scope of which is defined in the claims.

Claims

1. A washing machine including a tub (11) and rotatably mounted drum (20) within the tub (11) to receive laundry to be washed, the drum (20) having first and second end parts (21,22) spaced from each other by a cylindrical sidewall part (24) **characterised in that** the drum (20) is mounted for rotation about an axis inclined relative to the horizontal so that the sidewall part (24) is angled downwardly away from the second end part (22), the first end part (21) and the sidewall part (24) being completely closed to contain

water in the drum (20) and a plurality of drain holes (25) being formed in the second end part, to allow water to collect in the drum (20) in a region between the sidewall part (24) and the first end part (21), beneath the drain holes (25).

2. A washing machine including a tub (11) and rotatably mounted drum (20) within the tub (11) to receive laundry to be washed, the drum (20) having first and second end parts (21,22) spaced from each other by a cylindrical sidewall part (24) **characterised in that** the drum (20) is mounted for rotation about an axis inclined relative to the horizontal so that the sidewall part (24) is angled downwardly away from the second end part (22), wherein a plurality of drain holes (25) is formed in the second end part (22), the first end part (21) and the sidewall part (24) being completely closed to contain water in the drum (20) with the exception of additional drain holes (25b) being formed around the edge of the sidewall part (24) adjacent to the second end part (22), to allow water to collect in the drum (20) in a region between the sidewall part (24) and the first end part (21), beneath the drain holes (25, 25).
3. A washing machine according to claim 1 or claim 2, wherein the angle of inclination of the side wall part (24) relative to the horizontal is different to the angle of inclination of the axis about which the drum (20) rotates so that when the drum (20) rotates, water contained therein is directed toward the drain holes (25).
4. A washing machine according to claim 3, wherein the angle of inclination of the sidewall part (24) relative to the horizontal is less than the angle of inclination of the axis of rotation of the drum (20) relative to the horizontal.
5. A washing machine according to any preceding claim, wherein the plurality of drain holes (25) are arranged in a circular pattern in the second end part (22).
6. A washing machine according to claim 5, wherein the plurality of drain holes (25) in the second end part (22) are arranged in a first circular pattern and at least one further circular pattern concentric with the first circular pattern.
7. A washing machine according to claim 2, wherein the junction between said second end part (22) and the sidewall part (24) is curved and the drain holes (25) are formed in the curved region.
8. A washing machine according to any preceding claim comprising an inlet opening (23) formed in the second end part (22) of the drum (20) to be directed

upward and forward, a drive unit (13) to drive the drum (20) and a water circulation unit (60) to feed the water from the tub (11) into the drum (20).

- 5 9. The washing machine of claim 8 further comprising a heater (40) provided in a lower portion of the tub (11) which heats the water.
- 10 10. The washing machine of claim 8 or claim 9 further comprising a drain unit (50) having a drain pipe (51,53) connected to the lower portion of the tub (11) and a drain pump (52) mounted to an intermediate portion of the drain pipe (51).
- 15 11. The washing machine of any of claims 8 to 10, wherein the water circulation unit (60) comprising a control valve (61) mounted to the drain pipe (51) of the drain unit (50) at a position around an outlet of the drain pump (52) to control a flow direction of the water flowing from the drain pump (52), a water circulation pipe (62) extending from the control valve (61) to the inlet opening (23) of the drum (20) and a spray nozzle (63) mounted to an outlet of the water circulation pipe (62) to spray the water into the drum (20).
- 20 12. The washing machine of any of claims 8 to 11, wherein the first end part (21) closes the drum (20) and is coupled to a rotating shaft (12) at a centre of the first end part (21), the inlet opening (23) being provided at a central portion of the second end part (22) and wherein an inner diameter of the sidewall part (24) increases along a direction from the first end part (21) to the upwardly directed second end part (22) to allow an internal surface of the sidewall part (24) to be inclined.
- 25 13. The washing machine of any of claims 8 to 12 further comprising a detergent supplying unit (18) and a water supplying unit (30) installed in a housing (10) above the water to respectively feed each of a detergent and water into the tub (11).
- 30 14. The washing machine of claim 13 wherein the detergent supply unit (18) is placed a front part of the housing (10) to allow the user to feed the detergent into the tub (11).
- 35 15. The washing machine of claim 13 or claim 14 wherein the water supply unit (30) comprises a first water feed pipe (32) which extends from an external water supply pipe to the detergent supply unit (18), a second water feed pipe (33) which extends from the detergent supply unit (18) to the tub (11), and a control valve (34) which is mounted to an intermediate portion of the first water feed pipe (32) to control a flow of the water to be fed into the tub (11).
- 40 16. The washing machine of claim 9 wherein the heater
- 45
- 50
- 55

(40) is installed in a heater holding part (41) in which a predetermined amount of water is collected to a level to allow the heater (40) to be submerged into the water.

17. The washing machine of claim 16 wherein the heater holding part (41) has a pan-shaped appearance.
18. The washing machine of claim 10 wherein the drain pipe (51) comprises a first drain pipe (51) connected to a drain port (42) provided at a lower portion of the tub (11), and a second drain pipe (53) which extends from an outlet of the drain pump (52) and allows water to be drained to an outside of a housing (10).
19. A washing machine according to claim 1, wherein the drum (20) is installed in the tub (11) by use of a rotating shaft (12) and the side wall part (24) is inclined relative to the rotating axis of the drum (20) so that an inner diameter of the drum (20) increases along a direction from the first end part (21) coupled to the rotating shaft, to the second end part (22) having an inlet opening (23), the drum (20) being closed around the sidewall part (24) and a drain hole (25,25b) being provided on the drum (20) at a position adjacent to the inlet opening (23).
20. A washing machine according to claim 1, wherein the drum (20) is included in the tub (11) to be inclined so that the second end part (22) of the drum (20) having an inlet opening (23) is positioned to be higher than the first end part (21) of the drum (20) coupled to a rotating shaft (12) and the sidewall part (24) of the drum (20) being inclined so that an inner diameter of the drum (20) increases along a direction from the first end part (21) to the second end part (22), and a drain hole provided on the drum (20) at a position adjacent to the inlet opening (23) of the second end part (22), a drive unit (13) to drive the drum (20) and a water circulation unit (60) to feed the water from the tub (11) into the drum (20).

Patentansprüche

1. Waschmaschine, umfassend einen Wasserbehälter (11) und eine drehbar montierte Trommel (20) in dem Wasserbehälter (11), um zu waschende Wäsche aufzunehmen, wobei die Trommel (20) einen ersten und einen zweiten Endteil (21,22) aufweist, die durch einen zylindrischen Seitenwandteil (24) voneinander beabstandet sind, **dadurch gekennzeichnet, dass** die Trommel (20) zur Drehung um eine gegenüber der Horizontalen geneigte Achse montiert ist, sodass der Seitenwandteil (24) von dem zweiten Endteil (22) weg nach unten schräggestellt ist, wobei der erste Endteil (21) und der Seitenwandteil (24) vollständig geschlossen sind, um Wasser in der

Trommel (20) einzuschließen und eine Vielzahl von Ablauflöchern (25) in dem zweiten Endteil gebildet ist, um zuzulassen, dass sich Wasser in einer Region zwischen dem Seitenwandteil (24) und dem ersten Endteil (21) unter den Ablauflöchern (25) in der Trommel (20) ansammelt.

2. Waschmaschine, umfassend einen Wasserbehälter (11) und eine drehbar montierte Trommel (20) in dem Wasserbehälter (11), um zu waschende Wäsche aufzunehmen, wobei die Trommel (20) einen ersten und einen zweiten Endteil (21,22) aufweist, die durch einen zylindrischen Seitenwandteil (24) voneinander beabstandet sind, **dadurch gekennzeichnet, dass** die Trommel (20) zur Drehung um eine gegenüber der Horizontalen geneigte Achse montiert ist, sodass der Seitenwandteil (24) von dem zweiten Endteil (22) weg nach unten schräggestellt ist, wobei eine Vielzahl von Ablauflöchern (25) in dem zweiten Endteil (22) gebildet ist, wobei der erste Endteil (21) und der Seitenwandteil (24) vollständig geschlossen sind, um Wasser in der Trommel (20) einzuschließen, mit der Ausnahme, dass zusätzliche Ablauflöcher (25b) um den Rand des Seitenwandteils (24) benachbart dem zweiten Endteil (22) gebildet sind, um zuzulassen, dass sich Wasser in einer Region zwischen dem Seitenwandteil (24) und dem ersten Endteil (21) unter den Ablauflöchern (25,25b) in der Trommel (20) ansammelt.
3. Waschmaschine nach Anspruch 1 oder Anspruch 2, wobei der Neigungswinkel des Seitenwandteils (24) gegenüber der Horizontalen vom Neigungswinkel der Achse, um die sich die Trommel (20) dreht, verschieden ist, sodass, wenn sich die Trommel (20) dreht, darin enthaltenes Wasser zu den Ablauflöchern (25) geleitet wird.
4. Waschmaschine nach Anspruch 3, wobei der Neigungswinkel des Seitenwandteils (24) gegenüber der Horizontalen kleiner ist als der Neigungswinkel der Drehachse der Trommel (20) gegenüber der Horizontalen.
5. Waschmaschine nach einem der vorangehenden Ansprüche, wobei die Vielzahl von Ablauflöchern (25) in einem Kreismuster in dem zweiten Endteil (22) angeordnet sind.
6. Waschmaschine nach Anspruch 5, wobei die Vielzahl von Ablauflöchern (25) in dem zweiten Endteil (22) in einem ersten Kreismuster und mindestens einem weiteren, mit dem ersten Kreismuster konzentrischen Kreismuster angeordnet sind.
7. Waschmaschine nach Anspruch 2, wobei die Verbindung zwischen dem zweiten Endteil (22) und dem Seitenwandteil (24) gekrümmt ist und die Ablauflö-

cher (25) in der gekrümmten Region gebildet sind.

8. Waschmaschine nach einem der vorangehenden Ansprüche, umfassend eine Einlassöffnung (23), die in dem zweiten Endteil (22) der Trommel (20) gebildet ist, um nach oben und nach vorne gerichtet zu sein, eine Antriebseinheit (13) zum Antreiben der Trommel (20) und eine Wasserumwälzeinheit (60) zum Einspeisen des Wassers von dem Wasserbehälter (11) in die Trommel (20). 5
9. Waschmaschine nach Anspruch 8, weiter umfassend eine in einem unteren Abschnitt des Wasserbehälters (11) vorgesehene Heizvorrichtung (40), die das Wasser erwärmt. 10
10. Waschmaschine nach Anspruch 8 oder Anspruch 9, weiter umfassend eine Ablaufeinheit (50), die eine mit dem unteren Abschnitt des Wasserbehälters (11) verbundene Ablaufleitung (51,53) und eine an einem mittleren Abschnitt der Ablaufleitung (51) montierte Ablaufpumpe (52) aufweist. 15
11. Waschmaschine nach einem der Ansprüche 8 bis 10, wobei die Wasserumwälzeinheit (60) Folgendes umfasst: ein Steuerventil (61), das an einer Stelle um einen Auslass der Ablaufpumpe (52) an der Ablaufleitung (51) der Ablaufeinheit (50) montiert ist, um eine Strömungsrichtung des von der Ablaufpumpe (52) fließenden Wassers zu steuern, eine Wasserumwälzleitung (62), das sich von dem Steuerventil (61) zu der Einlassöffnung (23) der Trommel (20) erstreckt und eine Sprühdüse (63), die an einem Auslass der Wasserumwälzleitung (62) montiert ist, um das Wasser in die Trommel (20) zu sprühen. 20
12. Waschmaschine nach einem der Ansprüche 8 bis 11, wobei der erste Endteil (21) die Trommel (20) schließt und an eine Drehwelle (12) an einer Mitte des ersten Endteils (21) gekoppelt ist, wobei die Einlassöffnung (23) an einem mittleren Abschnitt des zweiten Endteils (22) vorgesehen ist und wobei ein Innendurchmesser des Seitenwandteils (24) entlang einer Richtung von dem ersten Endteil (21) zu dem nach oben gerichteten zweiten Endteil (22) zunimmt, um zuzulassen, dass eine innere Oberfläche des Seitenwandteils (24) geneigt ist. 25
13. Waschmaschine nach einem der Ansprüche 8 bis 12, weiter umfassend eine Waschmittel-Zufuhreinheit (18) und eine Wasserzufuhreinheit (30), die in einem Gehäuse (10) über dem Wasser installiert sind, um jeweils ein Waschmittel bzw. Wasser in den Wasserbehälter (11) einzuspeisen. 30
14. Waschmaschine nach Anspruch 13, wobei die Waschmittel-Zufuhreinheit (18) in einem vorderen Teil des Gehäuses (10) platziert ist, um zuzulassen, 35
15. Waschmaschine nach Anspruch 13 oder Anspruch 14, wobei die Wasserzufuhreinheit (30) Folgendes umfasst: eine erste Wasserspeiseleitung (32), die sich von einer externen Wasserzufuhrleitung zur Waschmittel-Zufuhreinheit (18) erstreckt, eine zweite Wasserspeiseleitung (33), die sich von der Waschmittel-Zufuhreinheit (18) zu dem Wasserbehälter (11) erstreckt und ein Steuerventil (34), das an einem mittleren Abschnitt der ersten Wasserspeiseleitung (32) montiert ist, um einen Fluss des in den Wasserbehälter (11) einzuspeisenden Wassers zu steuern. 40
16. Waschmaschine nach Anspruch 9, wobei die Heizvorrichtung (40) in einem Heizvorrichtung-Halteteil (41) installiert ist, in dem eine vorherbestimmte Wassermenge auf ein Niveau gesammelt wird, um zuzulassen, dass die Heizvorrichtung (40) in das Wasser eingetaucht wird. 45
17. Waschmaschine nach Anspruch 16, wobei der Heizvorrichtung-Halteteil (41) eine wannenförmige Erscheinung aufweist. 50
18. Waschmaschine nach Anspruch 10, wobei die Ablaufleitung (51) eine erste Ablaufleitung (51), die mit einem an einem unteren Abschnitt des Wasserbehälters (11) vorgesehenen Ablaufanschluss (42) verbunden ist und eine zweite Ablaufleitung (53), die sich von einem Auslass der Ablaufpumpe (52) erstreckt und zulässt, dass Wasser zu einem Äußeren eines Gehäuses (10) abgelassen wird, umfasst. 55
19. Waschmaschine nach Anspruch 1, wobei die Trommel (20) durch Verwendung einer Drehwelle (12) in dem Wasserbehälter (11) installiert ist und der Seitenwandteil (24) gegenüber der Drehachse der Trommel (20) geneigt ist, sodass ein Innendurchmesser der Trommel (20) entlang einer Richtung von dem ersten an die Drehwelle gekoppelten Endteil (21) zu dem eine Einlassöffnung (23) aufweisenden zweiten Endteil (22) zunimmt, wobei die Trommel (20) um den Seitenwandteil (24) geschlossen ist und ein Ablaufloch (25,25b) an einer Stelle benachbart der Einlassöffnung (23) an der Trommel (20) vorgesehen ist.
20. Waschmaschine nach Anspruch 1, wobei die Trommel (20) in dem Wasserbehälter (11) beinhaltet ist, um geneigt zu sein, sodass der eine Einlassöffnung (23) aufweisende zweite Endteil (22) der Trommel (20) dazu positioniert ist, höher zu sein als der an eine Drehwelle (12) gekoppelte erste Endteil (21) der Trommel (20) und der Seitenwandteil (24) der Trommel (20) geneigt ist, sodass ein Innendurch-

messer der Trommel (20) entlang einer Richtung von dem ersten Endteil (21) zu dem zweiten Endteil (22) zunimmt und wobei ein Ablaufloch an einer Stelle benachbart der Einlassöffnung (23) des zweiten Endteils (22) an der Trommel (20) vorgesehen ist, eine Antriebseinheit (13) zum Antreiben der Trommel (20) und eine Wasserumwälzeinheit (60) zum Einspeisen des Wassers von dem Wasserbehälter (11) in die Trommel (20).

Revendications

1. Machine à laver comprenant une cuve (11) et un tambour (20) monté de manière rotative à l'intérieur de la cuve (11) servant à recevoir du linge devant être lavé, le tambour (20) ayant des première et deuxième parties d'extrémité (21, 22) espacées l'une par rapport à l'autre par une partie de paroi latérale cylindrique (24), **caractérisée en ce que** le tambour (20) est monté à des fins de rotation autour d'un axe incliné par rapport à l'horizontale de telle sorte que la partie de paroi latérale (24) est inclinée vers le bas à l'opposé par rapport à la deuxième partie d'extrémité (22), la première partie d'extrémité (21) et la partie de paroi latérale (24) étant entièrement fermées pour contenir de l'eau dans le tambour (20) et une pluralité de trous de vidange (25) étant formés dans la deuxième partie d'extrémité, pour permettre à l'eau de s'accumuler dans le tambour (20) dans une région entre la partie de paroi latérale (24) et la première partie d'extrémité (21), sous les trous de vidange (25).
2. Machine à laver comprenant une cuve (11) et un tambour (20) monté de manière rotative à l'intérieur de la cuve (11) servant à recevoir du linge devant être lavé, le tambour (20) ayant des première et deuxième parties d'extrémité (21, 22) espacées l'une par rapport à l'autre par une partie de paroi latérale cylindrique (24), **caractérisée en ce que** le tambour (20) est monté à des fins de rotation autour d'un axe incliné par rapport à l'horizontale de telle sorte que la partie de paroi latérale (24) est inclinée vers le bas à l'opposé par rapport à la deuxième partie d'extrémité (22), dans laquelle une pluralité de trous de vidange (25) sont formés dans la deuxième partie d'extrémité (22), la première partie d'extrémité (21) et la partie de paroi latérale (24) étant entièrement fermées pour contenir de l'eau dans le tambour (20) à l'exception de trous de vidange supplémentaires (25b) qui sont formés autour du bord de la partie de paroi latérale (24) de manière adjacente par rapport à la deuxième partie d'extrémité (22), pour permettre à l'eau de s'accumuler dans le tambour (20) dans une région entre la partie de paroi latérale (24) et la première partie d'extrémité (21), sous les trous de vidange (25, 25b).

3. Machine à laver selon la revendication 1 ou la revendication 2, dans laquelle l'angle d'inclinaison de la partie de paroi latérale (24) par rapport à l'horizontale est différent de l'angle d'inclinaison de l'axe autour duquel le tambour (20) tourne de telle sorte que, quand le tambour (20) tourne, l'eau contenue dans celui-ci est dirigée vers les trous de vidange (25).
4. Machine à laver selon la revendication 3, dans laquelle l'angle d'inclinaison de la partie de paroi latérale (24) par rapport à l'horizontale est inférieur à l'angle d'inclinaison de l'axe de rotation du tambour (20) par rapport à l'horizontale.
5. Machine à laver selon l'une quelconque des revendications précédentes, dans laquelle la pluralité de trous de vidange (25) sont agencés selon une configuration circulaire dans la deuxième partie d'extrémité (22).
6. Machine à laver selon la revendication 5, dans laquelle la pluralité de trous de vidange (25) dans la deuxième partie d'extrémité (22) sont agencés selon une première configuration circulaire et au moins une autre configuration circulaire concentrique par rapport à la première configuration circulaire.
7. Machine à laver selon la revendication 2, dans laquelle la jonction entre ladite deuxième partie d'extrémité (22) et la partie de paroi latérale (24) est courbe et les trous de vidange (25) sont formés dans la région courbe.
8. Machine à laver selon l'une quelconque des revendications précédentes, comportant une ouverture d'entrée (23) formée dans la deuxième partie d'extrémité (22) du tambour (20) devant être dirigée vers le haut et vers l'avant, une unité d'entraînement (13) servant à entraîner le tambour (20) et une unité de circulation d'eau (60) servant à alimenter de l'eau depuis la cuve (11) jusque dans le tambour (20).
9. Machine à laver selon la revendication 8, comportant par ailleurs un élément chauffant (40) mis en oeuvre dans une partie inférieure de la cuve (11) qui chauffe l'eau.
10. Machine à laver selon la revendication 8 ou la revendication 9, comportant par ailleurs une unité de vidange (50) ayant un tuyau de vidange (51, 53) raccordé à la partie inférieure de la cuve (11) et une pompe de vidange (52) montée sur une partie intermédiaire du tuyau de vidange (51).
11. Machine à laver selon l'une quelconque des revendications 8 à 10, dans laquelle l'unité de circulation d'eau (60) comporte une vanne de régulation (61).

- montée au niveau du tuyau de vidange (51) de l'unité de vidange (50) au niveau d'une position autour d'une sortie de la pompe de vidange (52) pour réguler une direction d'écoulement de l'eau s'écoulant en provenance de la pompe de vidange (52), un tuyau de circulation d'eau (62) s'étendant depuis la vanne de régulation (61) jusqu'à l'ouverture d'entrée (23) du tambour (20) et une buse de pulvérisation (63) montée sur une sortie du tuyau de circulation d'eau (62) pour pulvériser l'eau dans le tambour (20).
12. Machine à laver selon l'une quelconque des revendications 8 à 11, dans laquelle la première partie d'extrémité (21) ferme le tambour (20) et est accouplée à un arbre tournant (12) au niveau d'un centre de la première partie d'extrémité (21), l'ouverture d'entrée (23) étant mise en oeuvre au niveau d'une partie centrale de la deuxième partie d'extrémité (22) et dans laquelle un diamètre intérieur de la partie de paroi latérale (24) augmente le long d'une direction allant de la première partie d'extrémité (21) jusqu'à la deuxième partie d'extrémité (22) dirigée vers le haut pour permettre à une surface interne de la partie de paroi latérale (24) d'être inclinée.
13. Machine à laver selon l'une quelconque des revendications 8 à 12, comportant par ailleurs une unité d'alimentation en produits détergents (18) et une unité d'alimentation en eau (30) installées dans un logement (10) au-dessus de l'eau à des fins d'alimentation respective de chacun parmi un produit détergent et de l'eau jusque dans la cuve (11).
14. Machine à laver selon la revendication 13, dans laquelle l'unité d'alimentation en produits détergents (18) est placée au niveau d'une partie avant du logement (10) pour permettre à l'utilisateur d'alimenter le produit détergent jusque dans la cuve (11).
15. Machine à laver selon la revendication 13 ou la revendication 14, dans laquelle l'unité d'alimentation en eau (30) comporte un premier tuyau d'alimentation en eau (32) qui s'étend depuis un tuyau d'alimentation en eau externe jusqu'à l'unité d'alimentation en produits détergents (18), un deuxième tuyau d'alimentation en eau (33) qui s'étend depuis l'unité d'alimentation en produits détergents (18) jusqu'à la cuve (11), et une vanne de régulation (34) qui est montée sur une partie intermédiaire du premier tuyau d'alimentation en eau (32) pour réguler un écoulement de l'eau devant être alimentée jusque dans la cuve (11).
16. Machine à laver selon la revendication 9, dans laquelle l'élément chauffant (40) est installé dans une partie de retenue (41) pour élément chauffant dans laquelle une quantité prédéterminée d'eau est accumulée jusqu'à un niveau permettant à l'élément
- chauffant (40) d'être submergé dans l'eau.
17. Machine à laver selon la revendication 16, dans laquelle la partie de retenue (41) pour élément chauffant a un aspect en forme de cuvette.
18. Machine à laver selon la revendication 10, dans laquelle le tuyau de vidange (51) comporte un premier tuyau de vidange (51) raccordé à un orifice de vidange (42) mis en oeuvre au niveau d'une partie inférieure de la cuve (11), et un deuxième tuyau de vidange (53) qui s'étend depuis une sortie de la pompe de vidange (52) et qui permet à l'eau d'être vidangée vers une partie extérieure d'un logement (10).
19. Machine à laver selon la revendication 1, dans laquelle le tambour (20) est installé dans la cuve (11) par l'utilisation d'un arbre tournant (12) et la partie de paroi latérale (24) est inclinée par rapport à l'axe de rotation du tambour (20) de telle sorte qu'un diamètre intérieur du tambour (20) augmente le long d'une direction allant depuis la première partie d'extrémité (21) accouplée à l'arbre tournant, jusqu'à la deuxième partie d'extrémité (22) ayant une ouverture d'entrée (23), le tambour (20) étant fermé autour de la partie de paroi latérale (24) et un trou de vidange (25, 25b) étant mis en oeuvre sur le tambour (20) au niveau d'une position adjacente par rapport à l'ouverture d'entrée (23).
20. Machine à laver selon la revendication 1, dans laquelle le tambour (20) est inclus dans la cuve (11) pour être incliné de telle sorte que la deuxième partie d'extrémité (22) du tambour (20) ayant une ouverture d'entrée (23) est positionnée pour être plus haute par rapport à la première partie d'extrémité (21) du tambour (20) accouplée à un arbre tournant (12) et la partie de paroi latérale (24) du tambour (20) étant inclinée de telle sorte qu'un diamètre intérieur du tambour (20) augmente le long d'une direction allant de la première partie d'extrémité (21) jusqu'à la deuxième partie d'extrémité (22), et un trou de vidange mis en oeuvre sur le tambour (20) au niveau d'une position adjacente par rapport à l'ouverture d'entrée (23) de la deuxième partie d'extrémité (22), une unité d'entraînement (13) servant à entraîner le tambour (20) et une unité de circulation d'eau (60) servant à alimenter l'eau depuis la cuve (11) jusque dans le tambour (20).

FIG. 1

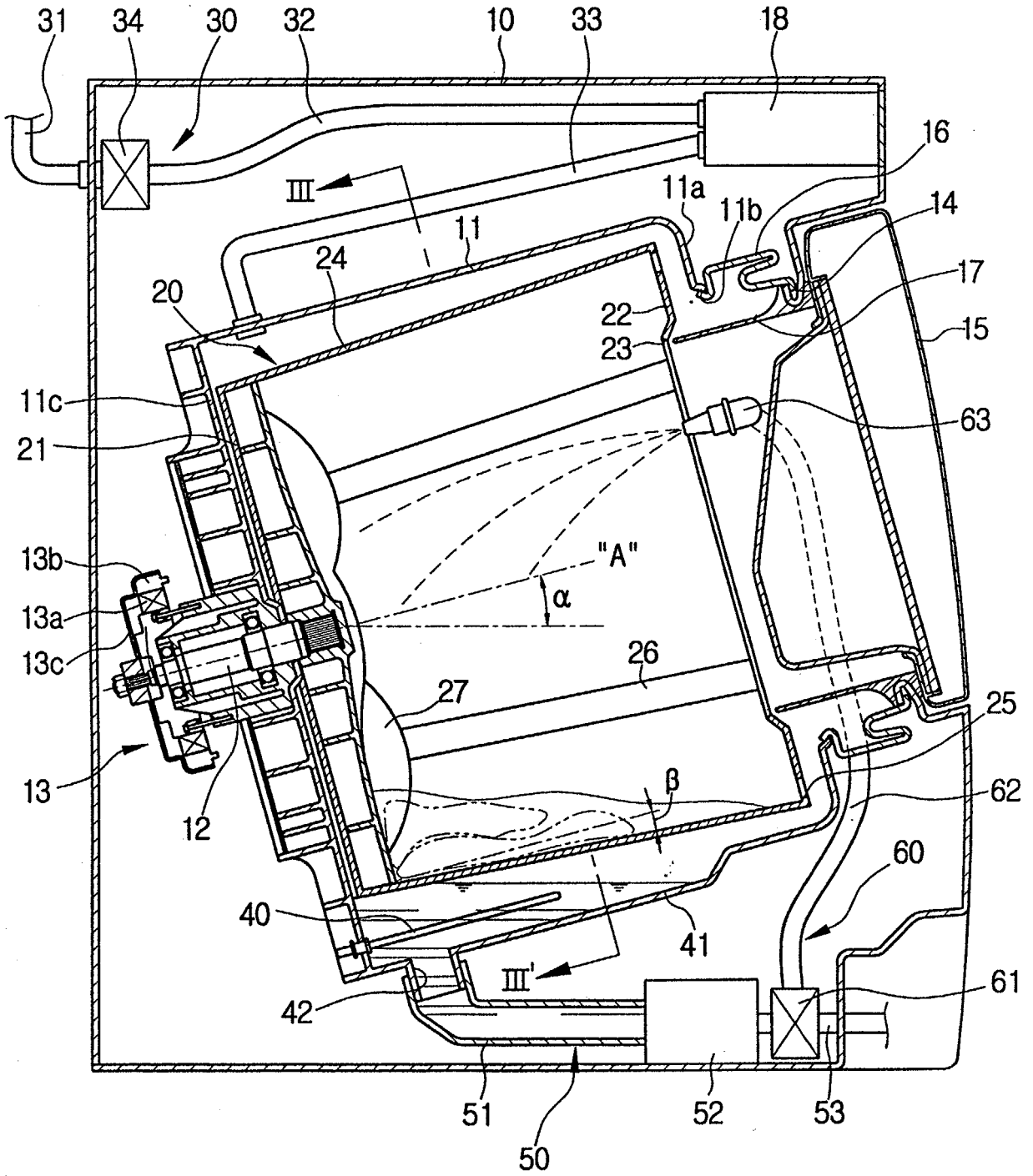


FIG. 2

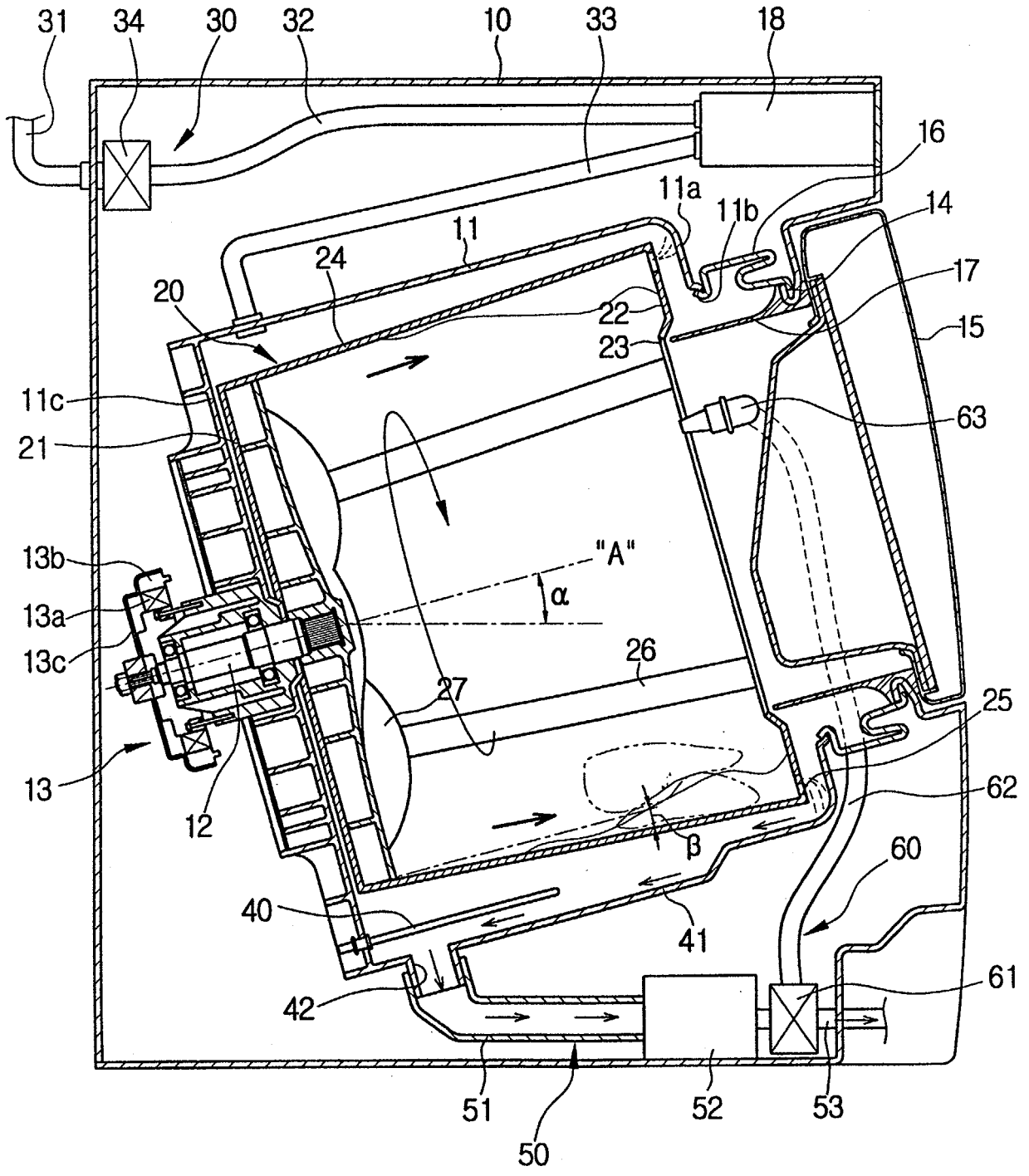


FIG. 3

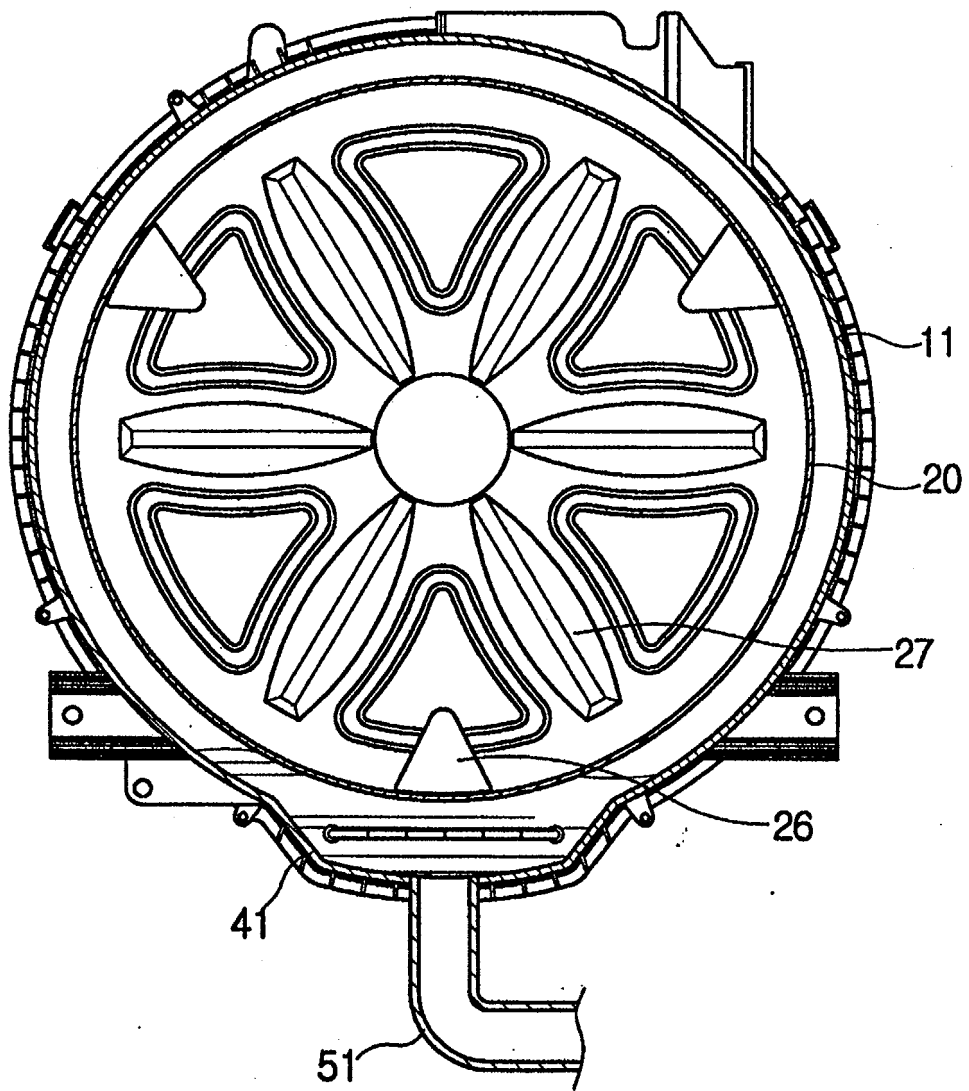


FIG. 4

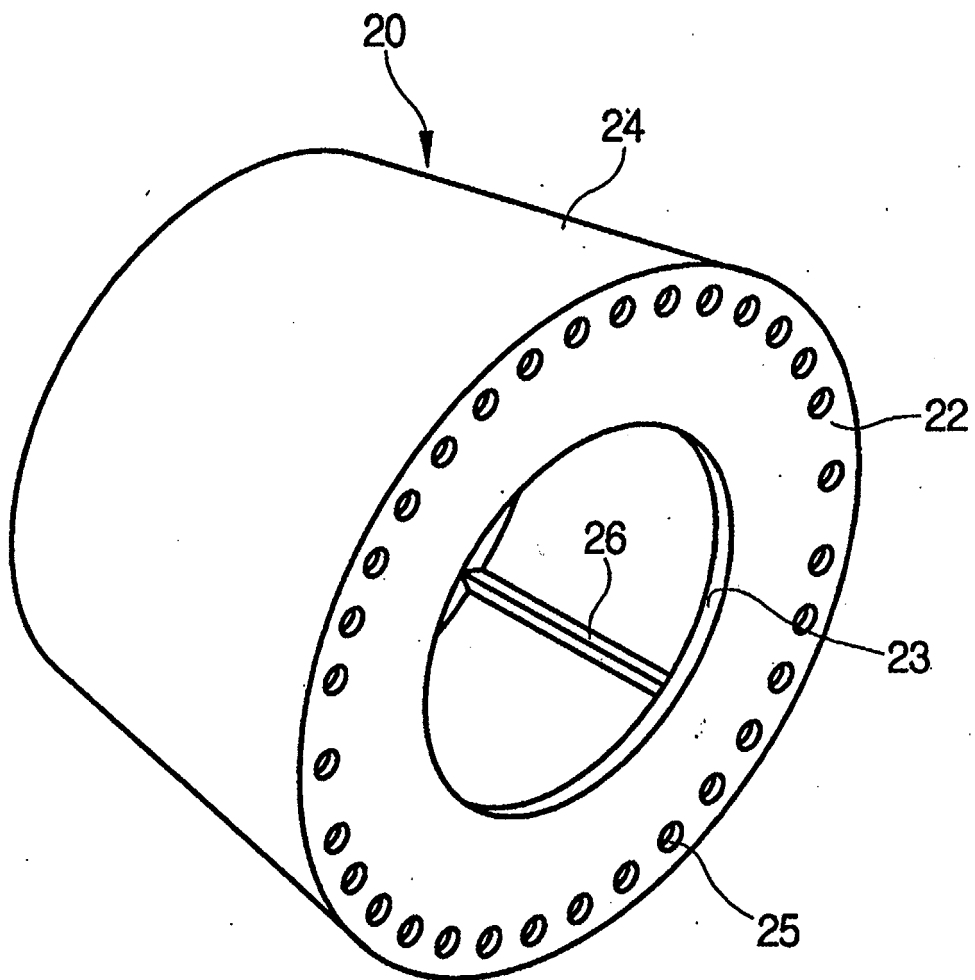


FIG. 5

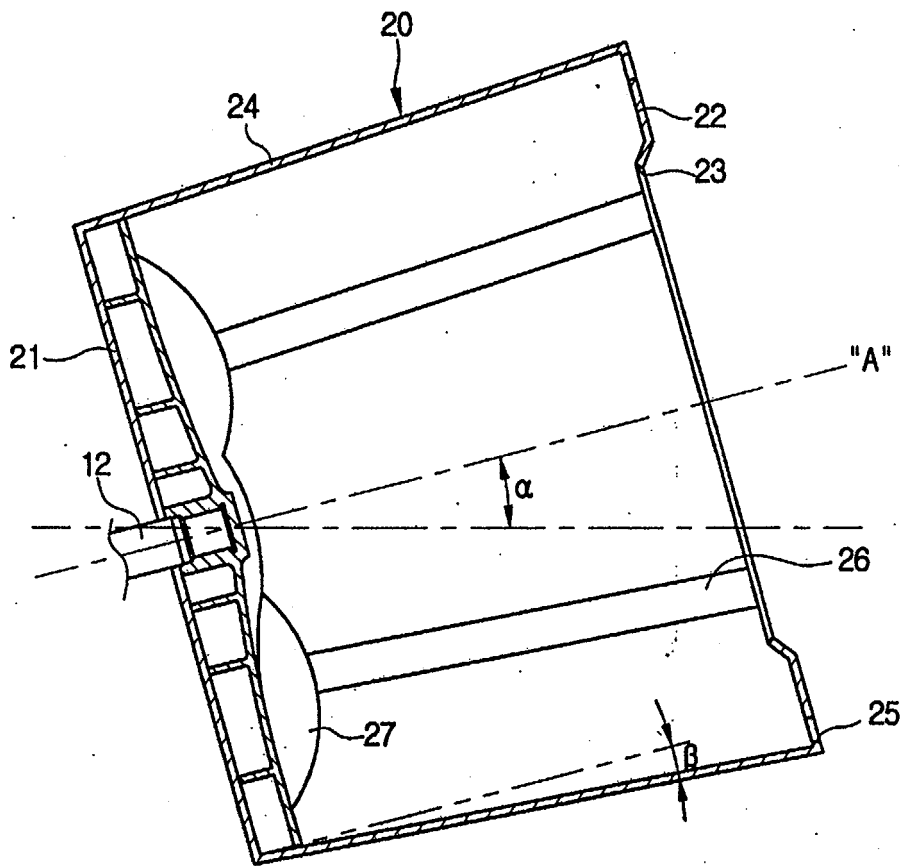


FIG. 6

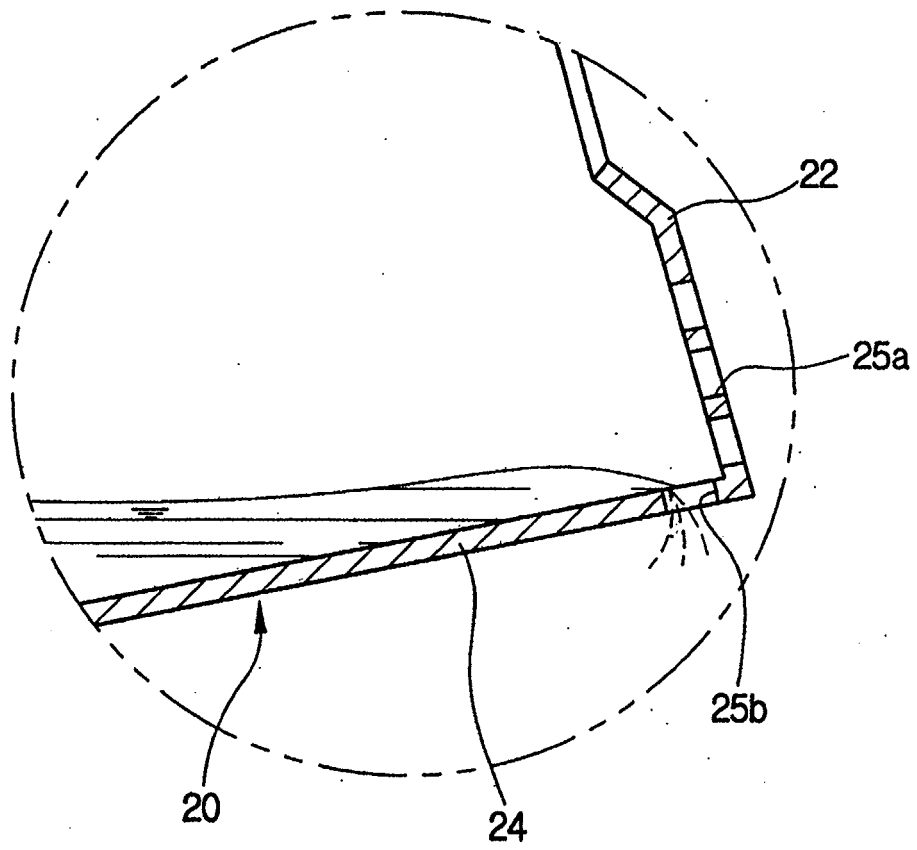
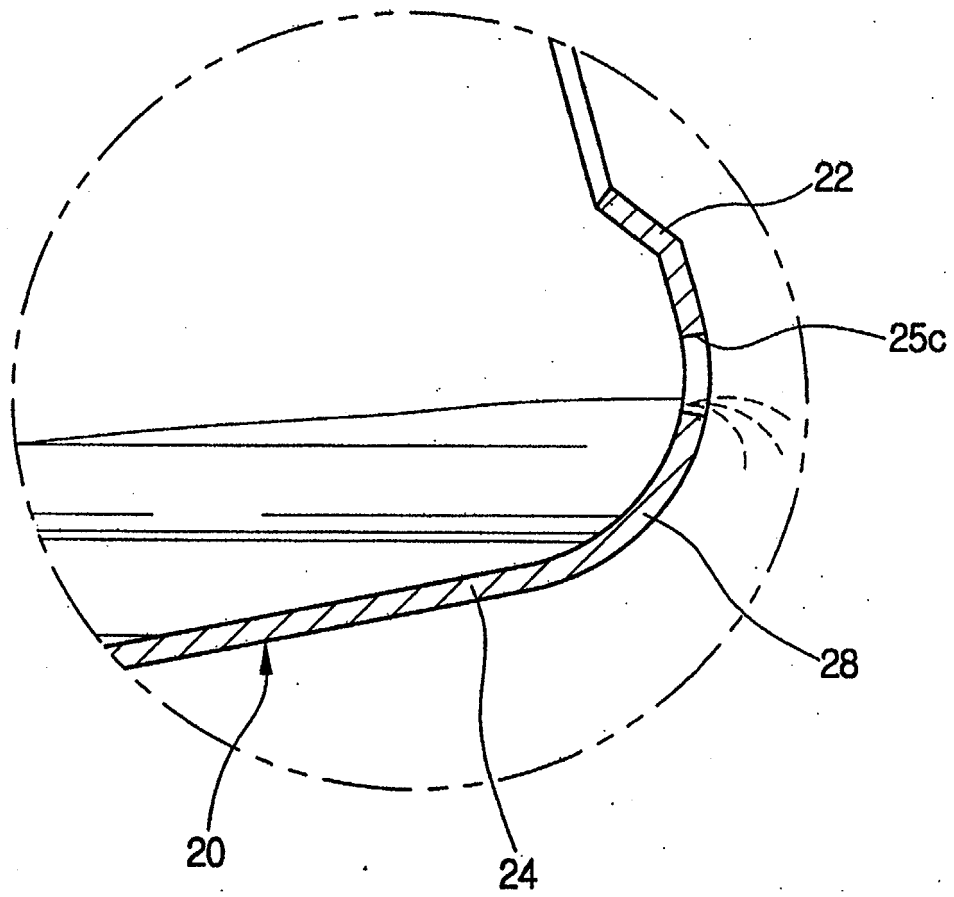


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2001149685 A [0002]
- US 6065312 A [0007]
- US 6553594 B [0007]