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(54) **Washing machine for drainage and circulation of wash water and controlling method thereof**

(57) A washing machine (100) can include a washing part (210) configured to wash, rinse, and/or spin-dry laundry after water is supplied to a washing tub (111) of the washing machine (100); a drain part (230), including a drain pipe (121) connected to the washing part (210) and a drain hose (122) connected to a drain hole (123), and a pump (120) configured to rotate an impeller (312) connected to a rotation shaft (311) of the pump (120) in a

forward direction or a backward direction; and a controller (220) configured to rotate the impeller (312) in the backward direction and circulate wash water into the washing tub (111) through the drain pipe (121) during a washing operation, and rotate the impeller (312) of the pump (120) in the forward direction and discharge the wash water through the drain hose (122) during a drain operation.

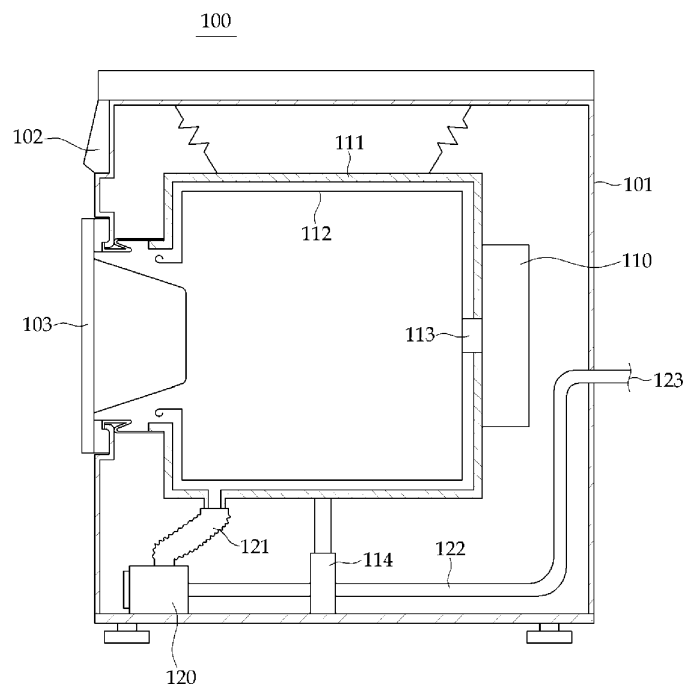


FIG. 1

Description

TECHNICAL FIELD

[0001] Embodiments according to the present disclosure relate to a washing machine and a method of controlling the washing machine, and more particularly, to a washing machine that drains and circulates wash water, and a method of controlling such a washing machine.

BACKGROUND

[0002] In general, a washing machine is an apparatus for removing foreign substances from laundry using a chemical action between water and detergent, and a physical action such as friction between water and laundry. The washing machine may additionally include a dryer for spin-drying and drying wet laundry, a refresher for conveniently washing laundry by spraying heated steam onto the laundry, and the like.

[0003] There are different types of washing machines such as, for example, an agitator type, a drum type, and a pulsator type, and accordingly there are different types of structures and washing methods. A washing machine washes laundry by sequentially performing a washing process, a rinsing process, and a spin-drying process. A washing machine may perform only some of these processes or a part of a process, according to a selection by a user. The washing may be performed using an appropriate washing method according to the type of laundry (e.g., normal, delicate, wool, permanent press, etc.).

[0004] When the washing process is started in a washing machine, wash water flows through a water supply device to a washing tub. When a predetermined level of wash water is reached inside the washing tub, a drum is rotated and the washing process is performed.

[0005] However, powdered detergent put into the washing tub is supplied to the drum in a non-dissolved state. There are many cases in which undissolved powdered detergent sinks to a bottom surface of the washing tub. Some of the undissolved detergent flows through, and occasionally partially or completely blocks, a drain pipe. The detergent is rarely entirely dissolved during the washing process, so that washing performance deteriorates.

SUMMARY

[0006] Embodiments according to the present disclosure provide a washing machine for drainage and circulation of wash water, which is capable of circulating or draining wash water by rotating an impeller of a multi-directional pump. In one embodiment, the impeller is angled relative to a rotation axis. The impeller can be rotated in different directions in a washing operation (e.g., during a washing cycle) and a drain operation (e.g., during a drain cycle). Embodiments according to the present disclosure also provide a method of controlling such a wash-

ing machine.

[0007] Embodiments according to the present disclosure also provide a washing machine for drainage and circulation of wash water, and which is capable of efficiently draining wash water and more easily dissolving detergent (e.g., powdered detergent) that is not dissolved and/or that may be on a bottom surface of a washing tub, by adding a normal impeller to a pump, and a method of controlling the washing machine.

[0008] One or more embodiments according to the present disclosure provide a washing machine, including: a washing part configured to wash, rinse, and/or spin-dry laundry after water is supplied to a washing tub in the washing machine; a drain part, including a drain pipe connected to the washing part and a drain hose connected to a drain hole, and also including a pump configured to rotate an impeller connected to a rotation shaft of the pump in a forward direction or in a backward direction; and a controller configured to control the impeller to rotate in the backward direction and circulate wash water into the washing tub through the drain pipe during a washing operation, and also configured to control the impeller to rotate in the forward direction and discharge the wash water through the drain hose in a drain operation.

[0009] In one embodiment, the impeller includes multiple blades that are attached to the rotation shaft diagonally (e.g., at an angle other than 0° or 180° relative to the axis of the rotation shaft). The impeller may further include a normal impeller connected with the rotation shaft of the pump in a normal direction, and the impeller and the normal impeller may be connected to each other.

[0010] When the controller controls the impeller of the pump to rotate in the backward direction in the washing operation, and a predetermined and/or initial washing time elapses, the controller may stop the rotation of the drain pump in the backward direction.

[0011] When the controller controls the impeller of the pump to rotate in the backward direction in the washing operation for each predetermined circulation cycle and the predetermined circulation cycle ends, then the controller may stop the rotation of the impeller of the pump in the backward direction.

[0012] One or more embodiments according to the present disclosure provide a method of controlling a washing machine, including: washing laundry using a washing part after water is supplied to a washing tub; rotating, in a backward direction, and under control of a controller, an impeller connected to a rotation shaft of a pump, and circulating wash water into the washing tub through a drain pipe; rotating, under control of the controller, the impeller in a forward direction and discharging the wash water through a drain hose; and rinsing and spin-drying the laundry.

[0013] In the washing operation, when the controller rotates the impeller of the pump in the backward direction and a predetermined and/or initial washing time elapses, then the controller may stop rotating the pump in the backward direction.

[0014] In a circulation operation, the controller may rotate the impeller of the pump in the backward direction for each predetermined circulation cycle.

[0015] In embodiments according to the present disclosure, it is possible to circulate and drain wash water by rotating the impeller of the pump in different directions.

[0016] In embodiments according to the present disclosure, the drain pump performs a circulation function, so that it is possible to prevent detergent from sinking to the bottom of the washing tub, and instead dissolve the detergent in the wash water in the tub.

[0017] In some or all embodiments according to the present disclosure, a normal impeller is added to the drain pump, thereby efficiently draining wash water and dissolving detergent which is not dissolved on a bottom surface of the washing tub.

[0018] The foregoing summary is illustrative only and is not intended to be limiting in any way. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a diagram of a washing machine according to one or more exemplary embodiments according to the present disclosure.

FIG. 2 is a block diagram showing elements of a washing machine according to one or more exemplary embodiments according to the present disclosure.

FIGS. 3 and 4 are each a perspective view of a pump included in a drain part according to one or more exemplary embodiments according to the present disclosure.

FIGS. 5 and 6 are each a perspective view of an impeller of a pump according to one or more exemplary embodiments according to the present disclosure.

FIGS. 7 and 8 are each a perspective view of an impeller and a normal impeller of a pump according to one or more exemplary embodiments according to the present disclosure.

FIG. 9 is a flowchart of a method of controlling a washing machine according to one or more exemplary embodiments according to the present disclosure.

DETAILED DESCRIPTION

[0020] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. The illustrative embodiments described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be utilized, and

other changes may be made, without departing from the spirit or scope of the subject matter presented here.

[0021] Hereinafter, exemplary embodiments according to the present disclosure will be described in detail with reference to the accompanying drawings.

[0022] In describing the exemplary embodiments, descriptions of technical contents that are well known in the technical field to which the present disclosure pertains and that are not directly related to the present disclosure will be omitted. Any unnecessary description is omitted, so that principal matter will be more clearly conveyed without obscuring the principal matter.

[0023] For the same reason(s), some constituent elements are exaggerated, omitted, or schematically illustrated in the accompanying drawings. The drawings are not necessarily drawn to scale. In the respective drawings, the same or corresponding elements will be designated by the same reference numerals.

[0024] FIG. 1 is a structural diagram of a washing machine according to one or more exemplary embodiments according to the present disclosure.

[0025] Referring to FIG. 1, a washing machine 100 according to exemplary embodiments according to the present disclosure structurally and generally includes a housing, a washing part for washing laundry, and a drain part for draining wash water. The housing includes a casing 101, a gauge 102, and a door 103. The washing part includes a motor 110, a washing tub 111, a drum 112, a driving shaft 113, and a damper 114. The drain part includes a pump 120, a drain pipe 121, a drain hose 122, and a drain hole 123.

[0026] Hereinafter, each of the constituent elements of the washing machine 100 according to exemplary embodiments according to the present disclosure will be described.

[0027] The washing tub 111 is supported inside the casing 101 by the damper 114.

[0028] The drum 112 generally has a cylindrical shape, and can rotate (e.g., is rotatably installed) inside the washing tub 111.

[0029] The door 103 is at the front side of the casing 101.

[0030] The motor 110 is installed toward the rear side of the washing tub 111 (e.g., the side opposite the side on which the door is installed). The motor 110 receives power and generates rotational force to rotate the drum 112. The driving motor 110 may include a stator fixed to a rear surface of the washing tub 111, and a rotor installed outside the stator. In order to directly transfer the driving force of the rotor to the drum 112, the driving shaft 113 rotates together with the drum 112 and is directly connected to the rotor.

[0031] The gauge 102 may be installed in an upper portion of the door 103. The gauge 102 receives a command for operating the washing machine from a user, and transfers the operating command to a controller to control a drainage and circulation function of the drain part.

[0032] The damper 114 is configured to attenuate vibrations of the washing tub 111 generated during spin-drying, and is installed between a lower side of an external peripheral surface of the washing tub 111 and a lower surface of the casing 101.

[0033] The pump 120 is configured to drain wash water, and is positioned at a lower portion of the washing tub 111. The washing tub 111 and the pump 120 are connected through the drain pipe 121. The pump 120 is connected with the drain hole 123 through the drain hose 122. The drain hose 122 guides wash water pumped by the pump 120 to be discharged to outside the washing machine.

[0034] The pump 120 is controlled by the controller, and performs a drain function and a circulation function by adjusting or changing the direction in which it is rotated between a forward direction and a backward direction under control of the controller. That is, the pump 120 may perform the drain function when an impeller of the pump 120 rotates in one direction (e.g., the forward direction), and may perform the circulation function when the impeller of the pump 120 rotates in another direction (e.g., the backward direction).

[0035] FIG. 2 is a block diagram showing elements of a washing machine according to exemplary embodiments according to the present disclosure. FIGS. 3 and 4 are each a perspective view of a drain pump included in a drain part according to exemplary embodiments according to the present disclosure.

[0036] A detailed configuration and operation of constituent elements of a washing machine 200 according to exemplary embodiments according to the present disclosure will be described with reference to FIGS. 2 to 4.

[0037] Referring to FIG. 2, the washing machine 200 according to exemplary embodiments according to the present disclosure includes a washing part 210, a controller 220, and a drain part 230. In one embodiment, the washing machine 200 is embodied as the washing machine 100 of FIG. 1.

[0038] When a supply of water into a washing tub (e.g., the washing tub 111 of FIG. 1) is completed, the washing part 210 performs one or more operations such as washing, rinsing, and/or spin-drying.

[0039] Referring also to FIG. 3, the drain part 230 includes a drain pipe connection part 321 connected with the washing part 210, and a drain hose connection part 322 that is connected with the drain hose 122 that is connected with the drain hole 123. The drain pump 120 includes a drain motor 310 and a pump housing 320. The pump housing 320 includes the drain pipe connection part 321 connected with the drain pipe 121, and the hose connection part 322 connected with the drain hose 122.

[0040] The drain part 230 includes the pump 120 configured to rotate an impeller 312, and connected with a rotation shaft 311 of a drain motor 310. The impeller 312 can rotate in the forward direction and in the backward direction.

[0041] Referring to FIG. 4, the pump 120 includes the

impeller 312 connected with the rotation shaft 311 of the drain motor 310 in the "diagonal" direction. That is, relative to the longitudinal axis of the shaft, the impeller is diagonal (neither parallel nor perpendicular), or at an angle (e.g., other than 0, 90 or 180 degrees). For example, in one embodiment, the impeller 312 has blades or wings that are connected to the rotation shaft 311 diagonally, or at an angle, in the manner shown in FIG. 6. In one such embodiment, the impeller 312 is connected with the rotation shaft 311 in a diagonal direction to impart directionality (e.g., to the liquid being pumped) in both rotating directions (e.g., forward and backward) of the rotation shaft 311.

[0042] Thus, for example, when the impeller 312 is rotated in one direction (e.g., the forward direction) (e.g., in a drain operation), wash water moves in the direction from the drain motor 310 to the pump housing 320.

[0043] On the other hand, the controller 220 can cause the impeller 312 to rotate in the other direction (e.g., the backward direction) (e.g., in a washing operation) so as to circulate the wash water into the washing tub 111 through the drain pipe 121. That is, when the impeller 312 is rotated in the backward direction, the wash water moves in the direction from the pump housing 320 to the drain motor 310. The wash water is then circulated to the washing tub 111 through the drain pipe 121 connected to an upper side of the drain motor 310. The circulation function of the pump 120 can prevent detergent from sinking to the washing tub 111 or the drain pipe 121, thereby causing the detergent that may be present at the bottom of the tub to be dissolved in the wash water. The controller 220 causes the wash water to be discharged through the drain hose 122 by rotating the impeller 312 of the pump 120 in the forward direction during the drain operation.

[0044] In one embodiment, the controller 220 rotates the impeller 312 of the drain pump 120 in the backward direction during the washing operation for a predetermined and/or initial washing time. For example, when the predetermined and/or initial washing time for dissolving detergent is five (5) minutes, the pump 120 may rotate in the backward direction for 5 minutes after starting the washing under control of the controller 220. The initial washing time is not limited to a specific time, and may be arbitrarily set or changed at the factor and/or by a wholesaler, retailer, and/or user. When the predetermined initial washing time elapses, the controller 220 stops the rotation of the drain pump in the backward direction.

[0045] The controller 220 may rotate the impeller 312 of the pump 120 in the backward direction for each predetermined circulation cycle of the washing operation. As described above, when the impeller 312 of the pump 120 is rotated in the backward direction for the predetermined circulation cycle, detergent that sank inside the washing tub 111 or to the drain pipe 121 can be dissolved.

[0046] FIGS. 5 and 6 are each a perspective view of an impeller of a drain pump according to exemplary embodiments according to the present disclosure.

[0047] Referring to FIGS. 5 and 6, the impeller 312 is connected with the rotation shaft 311 of the drain motor 310. Here, the angle between the impeller 312 and the rotation shaft 311 may be set according to the structure or capacity of the drain motor 310.

[0048] In one embodiment, the impeller 312 includes three blades or wings, but is not limited to that specific number of blades/wings. The blades of the impeller 312 may have a shape of a fan blade, a triangle, an ellipse, and the like, in addition to being angled relative to the rotation shaft 311 (in the diagonal direction), and are not limited to a specific shape.

[0049] When the impeller 312 is rotated in the backward direction, the diagonal direction of the impeller 312 (e.g., the angle of the impeller blades) pushes water inside the pump housing 320 in the direction of the washing tub 111 through the drain pipe connection part 321. In this case, the impeller 312 performs a function of dissolving the detergent stacked on a lower end of the washing tub 111 and circulating the wash water into the washing tub 111. On the other hand, when the impeller 312 is rotated in the forward direction, the diagonal direction (angle) of the impeller 312 (e.g., the angle of the impeller blades) pushes the wash water flowing in through the drain pipe connection part 321 in the direction of the drain hose 122 through the hose connection part 322 of the pump housing 320.

[0050] That is, when the impeller 312 is rotated in the forward direction, the wash water moves in the direction from the drain motor 310 to the pump housing 320. On the other hand, when the impeller 312 is rotated in the backward direction, the wash water moves in the direction from the pump housing 320 to the drain motor 310.

[0051] FIGS. 7 and 8 are each a perspective view of an impeller and a normal (perpendicular, relative to the plane of rotation) impeller of a drain pump according to another exemplary embodiment according to the present disclosure.

[0052] Referring to FIGS. 7 and 8, the drain part 230 may further include normal impellers 313 connected with the rotation shaft 311 of the drain motor 310 in a normal direction. Surfaces or edges of the impeller 312 and the normal impellers 313 are connected with each other. In other words, in one embodiment, each blade of the impeller 312 includes (e.g., is connected with) a normal impeller 313. In one embodiment, the normal impellers 313 are also connected with the rotation shaft 311. The normal impellers 313 are attached in a normal direction relative to the plane in which the impeller 312 rotates.

[0053] When the impeller 312 and the normal impeller 313 are rotated in the backward direction, the impeller 312 and the normal impeller 313 push the water inside the pump housing 320 in the direction of the washing tub 111 through the drain pipe connection part 321. In this case, the impeller 312 and the normal impeller 313 perform a function of dissolving the detergent at a lower end or the bottom of the washing tub 111, and circulating the wash water into the washing tub 111.

[0054] On the other hand, when the impeller 312 and the normal impeller 313 rotate in the forward direction, the impeller 312 and the normal impeller 313 push the wash water flowing in through the drain pipe connection part 321 in the direction of the drain hose 122 through the hose connection part 322 of the pump housing 320.

[0055] FIG. 9 is a flowchart of a method of controlling a washing machine for drainage and circulation of wash water according to one or more exemplary embodiments according to the present disclosure.

[0056] The washing part 210 (FIG. 2) supplies wash water into the washing tub (S902).

[0057] The washing part 210 checks whether the supply of the wash water to the washing tub for preparation of washing is complete (S904).

[0058] As a result of the check (S904), when the supply of the wash water is complete, the controller 220 rotates the pump 120 in the backward direction, and circulates the wash water through the rotation of the impeller 312 included in the drain pump 120 in the backward direction (S906). Here, the impeller 312 is connected with the rotation shaft 311 of the drain motor 310 in the diagonal direction as described above. The pump 120 may further include the normal impeller 313 connected with a side surface of the impeller 312 in the rotation shaft 311. On the other hand, when the supply of the wash water is not completed, the washing part 210 continues to supply wash water into the washing tub (S902).

[0059] The controller 220 then checks whether a predetermined and/or initial washing time elapses (S908).

[0060] As a result of the check in process S908, when the predetermined and/or initial washing time elapses, the controller 220 stops the rotation of the pump 120 in the backward direction (S910). In this case, the controller 220 rotates the pump 120 in the backward direction until the predetermined and/or initial washing time elapses.

[0061] Then, the washing part 210 checks whether the washing of laundry is completed (S912).

[0062] As a result of the check (S912), and after the laundry is washed, the drain part 230 drains the wash water (S914).

[0063] When drainage of the wash water is started, the controller 220 rotates the pump 120 in the forward direction, and drains the wash water through the rotation of the impeller 312 included in the pump 120 in the forward direction (S916).

[0064] The controller 220 checks whether the drainage of the wash water is completed (S918).

[0065] As a result of the check (S918), when the drainage of the wash water is completed, the controller 220 rinses the laundry by controlling the washing part 210 (S920). On the other hand, when the drainage of the wash water is not completed, the drain part 230 rotates the pump 120 in the forward direction so as to continue draining the wash water by rotating the pump 120 in the forward direction (S916).

[0066] When the laundry rinsing process is completed, the washing part 210 can spin-dry the laundry (S922).

[0067] From the foregoing, it will be appreciated that various embodiments of the present disclosure have been described herein for purposes of illustration, and that various modifications may be made without departing from the scope and spirit of the present disclosure. Accordingly, the various embodiments disclosed herein are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

Claims

1. A washing machine, comprising:

a washing part(210) configured to wash, rinse, and/or spin-dry laundry after water is supplied to a washing tub(111) in the washing machine; a drain part(230) comprising a drain pipe(121) coupled to the washing part(210) and a drain hose(122) coupled to a drain hole(123), and further comprising a pump(120) configured to rotate an impeller(312) coupled to a rotation shaft(311) of the pump(120) in a forward direction or in a backward direction; and a controller(220) coupled to the drain part(230) and configured to control the impeller(312) to rotate in the backward direction and circulate wash water into the washing tub(111) through the drain pipe(121) during a washing operation, and further configured to control the impeller(312) to rotate in the forward direction and discharge the wash water through the drain hose(122) during a drain operation.

2. The washing machine of claim 1, wherein the impeller(312) is attached to the rotation shaft(311) at an angle other than 0, 90 or 180 degrees relative to the rotation shaft(311).

3. The washing machine of claim 2, wherein the impeller(312) further comprises a normal impeller(313) connected with the rotation shaft(311) of the pump(120) in a normal direction relative to the plane in which the impeller(312) rotates.

4. The washing machine of claim 3, wherein the impeller(312) and the normal impeller(313) are connected with each other.

5. The washing machine of claim 1, wherein when the controller(220) controls the impeller(312) of the pump(120) to rotate in the backward direction in the washing operation, and in response to a predetermined and/or initial washing time elapsing, the controller(220) stops the rotation of the impeller(312) of the pump(120) in the backward direction.

6. The washing machine of claim 1, wherein when the

controller(220) rotates the impeller(312) of the pump(120) in the backward direction for each predetermined circulation cycle of the washing operation, and when each predetermined circulation cycle ends, then the controller(220) stops the rotation of the impeller(312) of the pump(120) in the backward direction.

7. A method of controlling a washing machine, comprising:

washing laundry using a washing part(210) of the washing machine after water is supplied to a washing tub(111) of the washing machine; during the washing operation, under control of a controller(220), rotating in a backward direction an impeller(312) connected with a rotation shaft(311) of a pump(120) and circulating wash water into a washing tub(111) through a drain pipe(121); rotating, under control of the controller(220), the impeller(312) in a forward direction and discharging wash water through a drain hose(122); and rinsing and spin-drying the laundry.

8. The method of claim 7, wherein in the washing operation, when the impeller(312) of the pump(120) is rotating in the backward direction and a predetermined and/or initial washing time elapses, then the controller(220) stops the rotation of the impeller(312) in the backward direction.

9. The method of claim 7, wherein in the washing operation, when the impeller(312) of the pump(120) is rotating in the backward direction for a predetermined circulation cycle of the washing operation and the circulation cycle ends, then the controller(220) stops the rotation of the impeller(312) in the backward direction.

10. The method of claim 7, wherein the impeller(312) comprises a plurality of blades, and each of the blades is attached to the rotation shaft(311) at an angle other than parallel or at a right angle relative to the rotation shaft(311).

11. The method of claim 10, wherein each of the blades comprises a normal impeller(313) that is normal to the plane in which the impeller(312) rotates.

12. A washing machine, comprising:

a washing part(210) configured to wash, rinse, and/or spin-dry laundry after water is supplied into a washing tub(111) of the washing machine; and a pump(120) comprising an impeller(312) cou-

pled to a rotation shaft(311) of the pump(120) and configured to rotate in a forward direction and also configured to rotate in a backward direction, the pump(120) coupled to a drain pipe(121) coupled to (i) the washing part(210) and (ii) a drain hose(122) coupled to a drain hole(123); wherein the impeller(312) rotates in the backward direction and circulates wash water into the washing tub(111) through the drain pipe(121) during washing, and rotates in the forward direction and discharges the wash water through the drain hose(122) after washing and rinsing and during spin-drying.

13. The washing machine of claim 12, wherein the impeller(312) is attached to the rotation shaft(311) at an angle other than a right angle relative to the rotation shaft(311).

14. The washing machine of claim 13, wherein the impeller(312) further comprises a normal impeller(313) connected with the rotation shaft(311) of the pump(120) in a normal direction relative to the plane in which the impeller(312) rotates.

15. The washing machine of claim 12, wherein when the impeller(312) of the pump(120) rotates in the backward direction during washing, and stops after a predetermined and/or initial time.

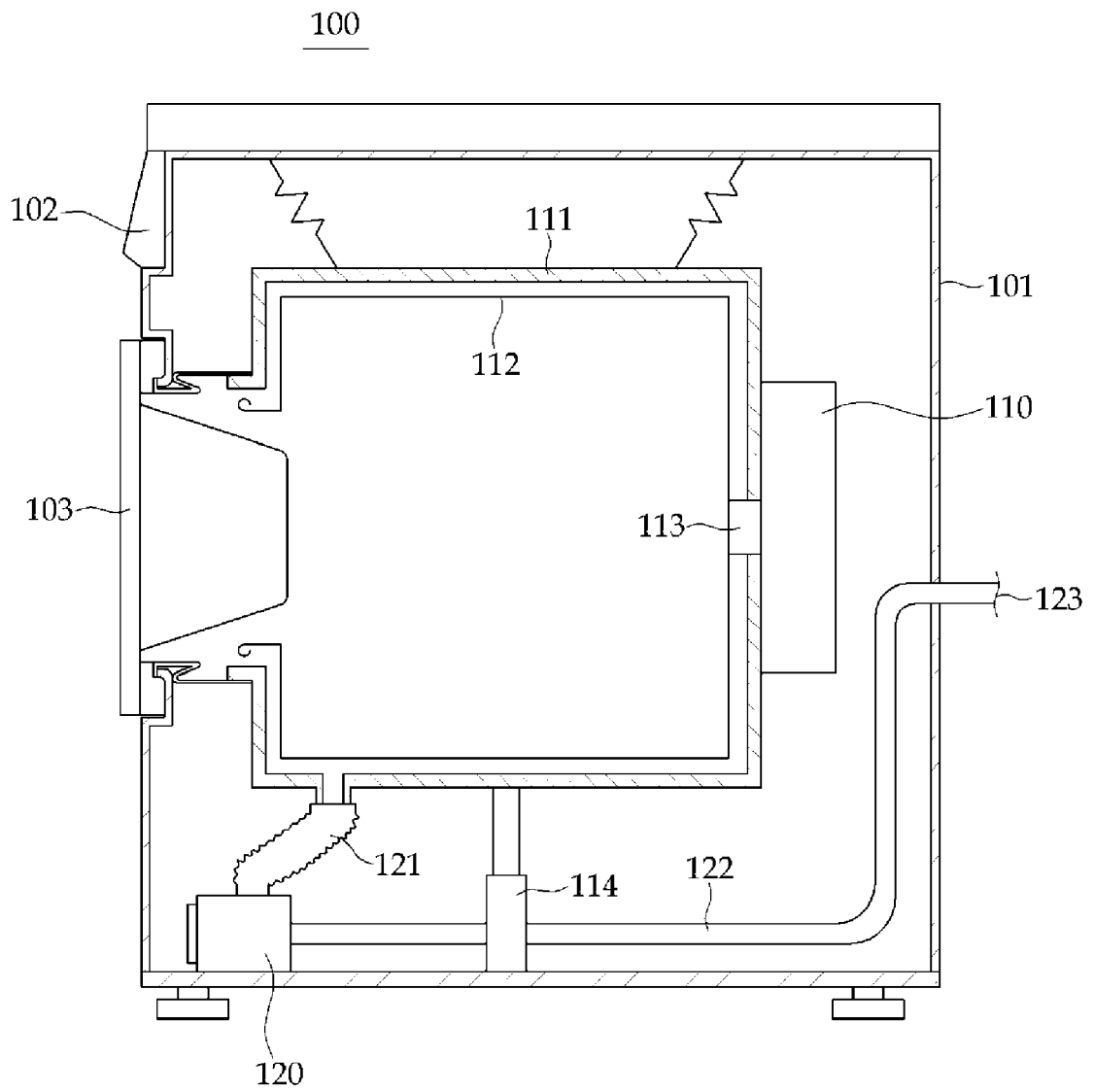


FIG. 1

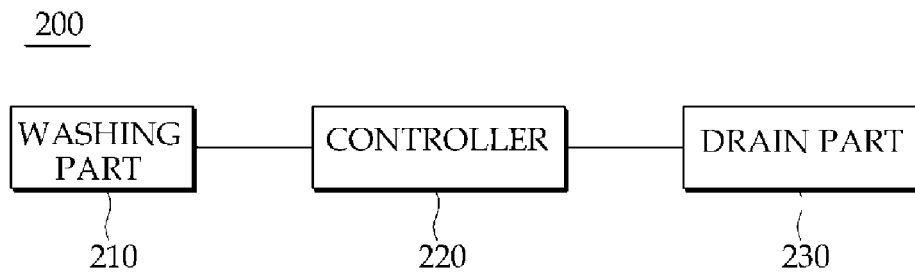


FIG. 2

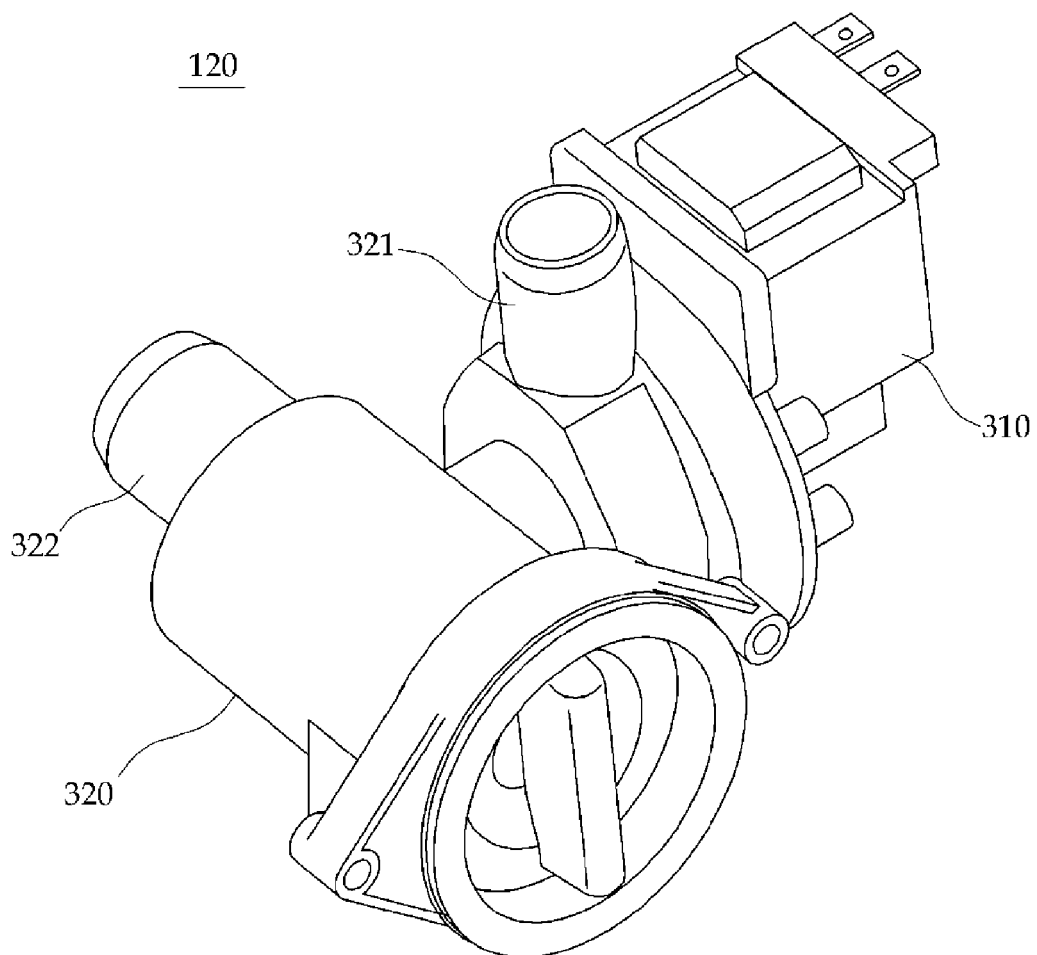


FIG. 3

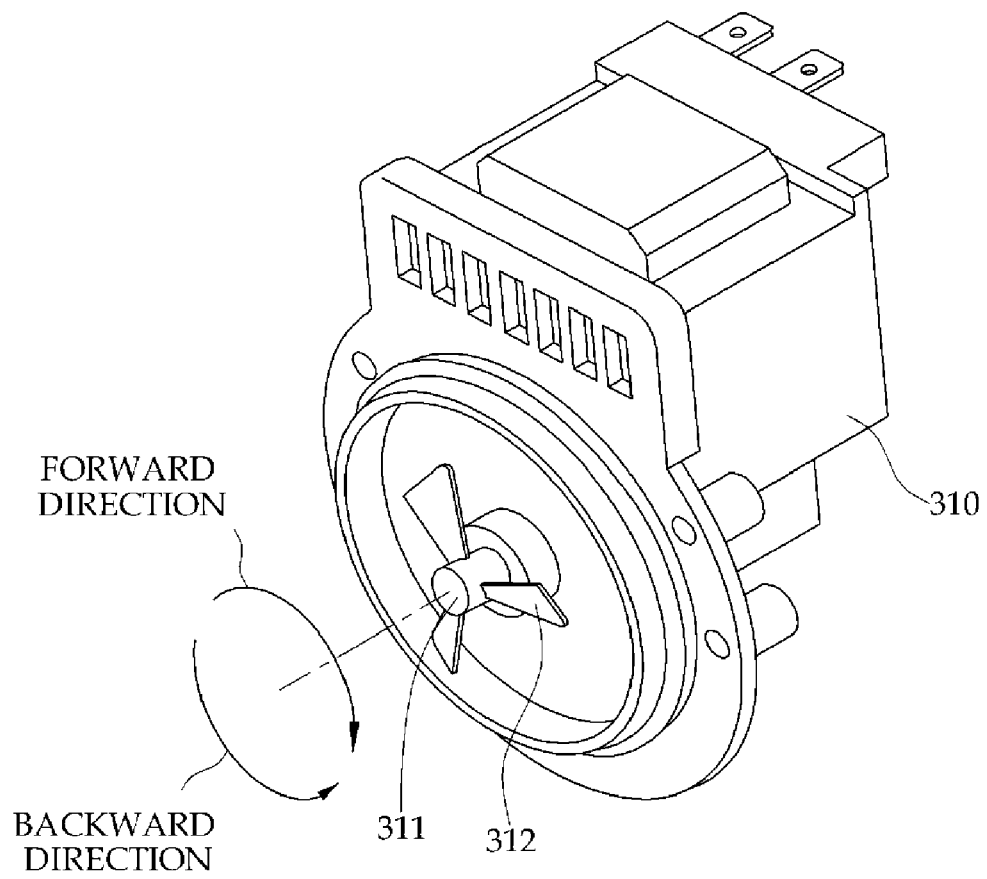


FIG. 4

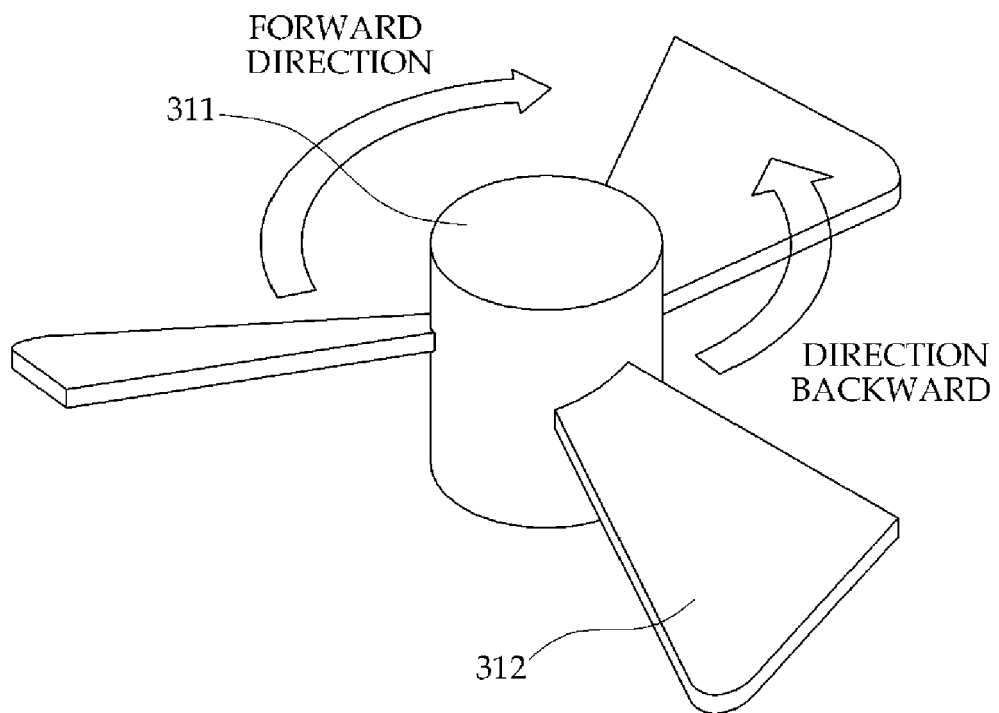


FIG. 5

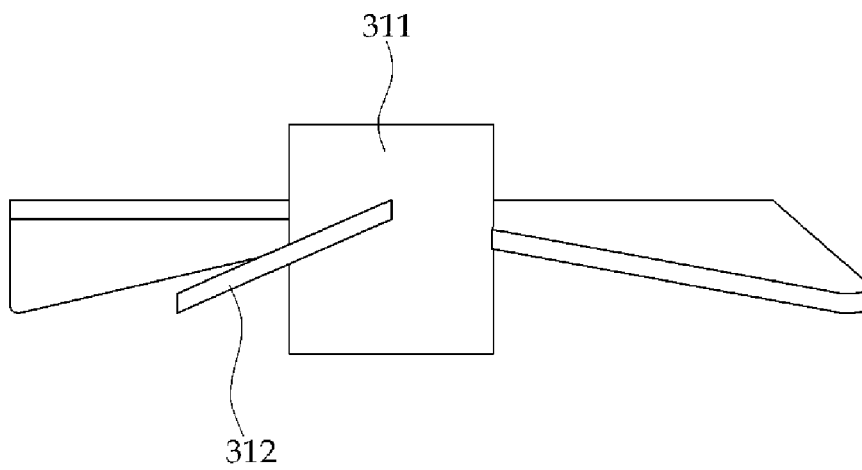


FIG. 6

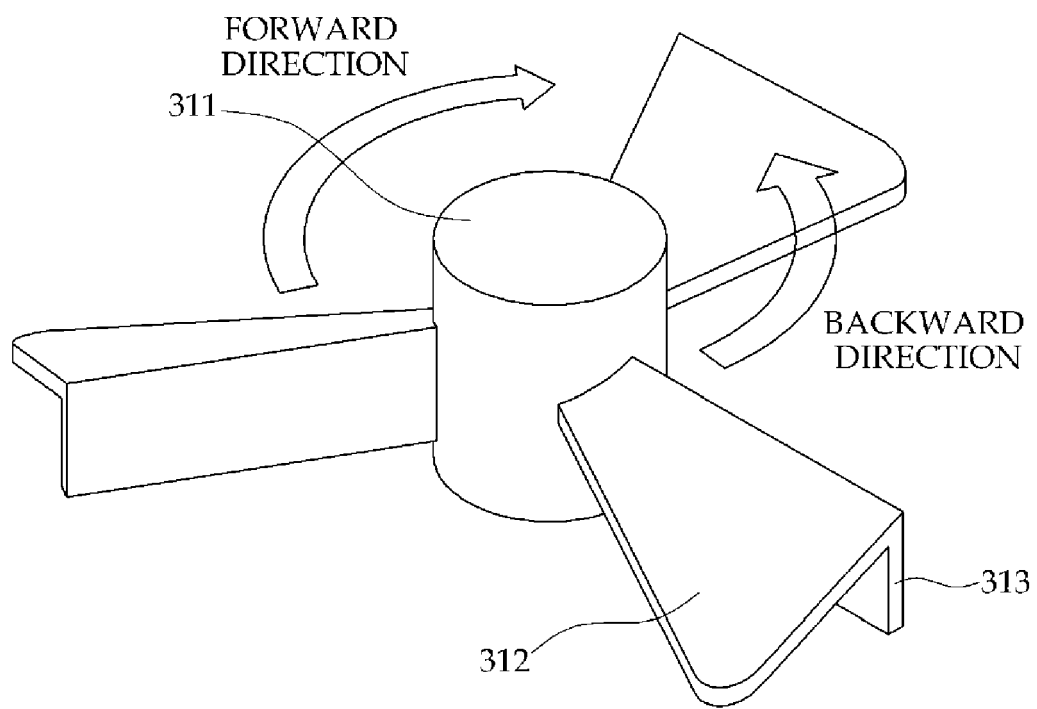


FIG. 7

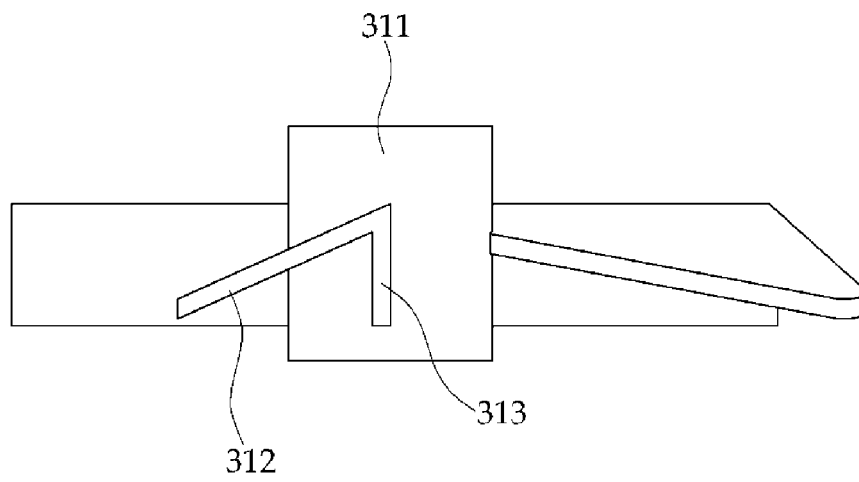


FIG. 8

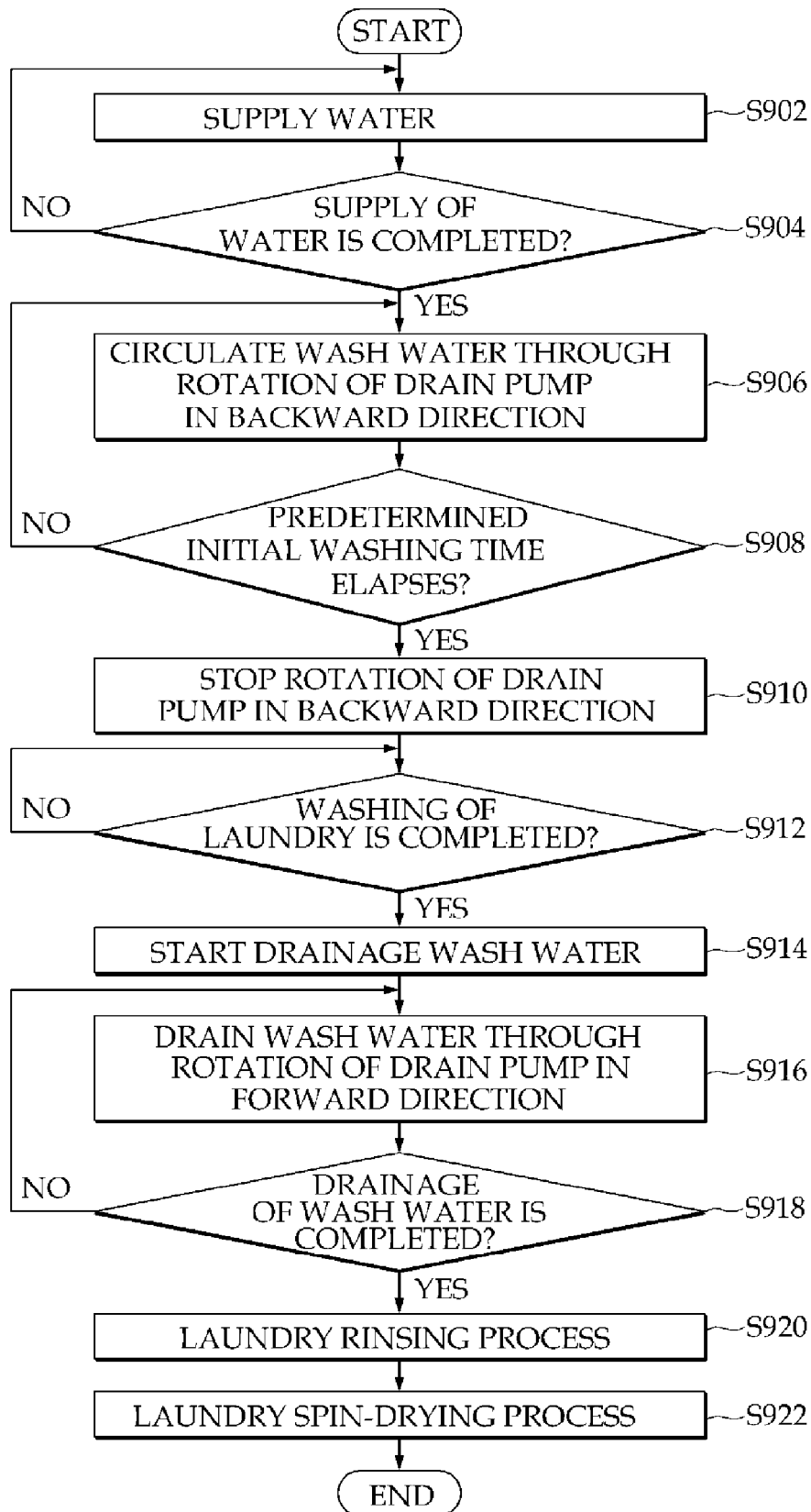


FIG. 9



EUROPEAN SEARCH REPORT

Application Number
EP 14 17 7169

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 10 2009 046782 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 17 June 2010 (2010-06-17) * paragraph [0005] - paragraph [0036]; figures 1-3 *	1-15	INV. D06F39/08 D06F33/02
X	DE 37 04 039 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 18 August 1988 (1988-08-18) * column 2, line 7 - column 3, line 20; figures 2,3 *	1-15	
X	GB 2 166 163 A (BOSCH SIEMENS HAUSGERAETE) 30 April 1986 (1986-04-30) * page 1, line 38 - page 2, line 102; figure 1 *	1-15	
A	US 3 136 254 A (DOUGLAS PEYTON W) 9 June 1964 (1964-06-09) * column 1, line 62 - column 4, line 35; figures 1-6 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 March 2015	Examiner Engelhardt, Helmut
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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