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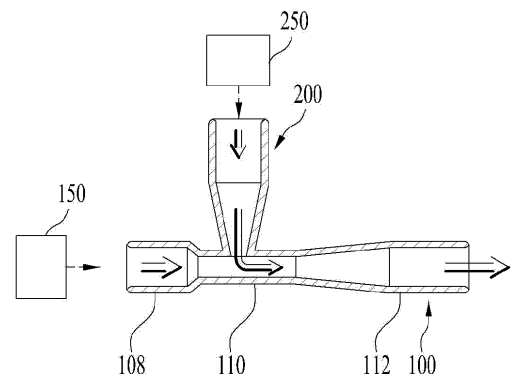
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(54) **LAUNDRY PROCESSING APPARATUS**

(57) A laundry processing apparatus is disclosed. A laundry processing apparatus according to an embodiment of the present invention comprises: a cabinet; a tub provided in the cabinet and receiving water; a drum provided in the tub and receiving clothes; a water supply tube which is provided in the cabinet and through which water provided from an external water supply source flows; and a detergent pipe which is provided in the cabinet and through which detergent discharged from a detergent storage unit in which the detergent is stored flows, wherein the cross-sectional area of the water supply tube decreases along the flow direction of the water and then increases again to form a neck unit, and the detergent pipe is connected to the neck unit to provide detergent into the water supply tube through the neck unit.

[FIG. 4]



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Description

[Technical Field]

[0001] The present disclosure relates to a laundry treating apparatus, and more particularly, to a laundry treating apparatus that performs a washing course of laundry as detergent is injected.

[Background]

[0002] A laundry treating apparatus is an apparatus that may put clothes, bedding, and the like (hereinafter, referred to as laundry) into a drum to perform a washing course that removes contaminants from the laundry. In addition to the washing course, the laundry treating apparatus may perform a rinse course, a dehydration course, a drying course, and the like.

[0003] The laundry treating apparatus may include a cabinet forming an outer appearance thereof, a tub disposed inside the cabinet, and the drum rotatably disposed inside the tub and accommodating the laundry therein.

[0004] The laundry treating apparatuses may be categorized into a top loading type and a front loading type based on a scheme of putting the laundry into the drum. The top loading type may put the laundry via a top surface of the cabinet, and the front loading type may put the laundry via a front surface of the cabinet.

[0005] The laundry treating apparatus may include a detergent supply device that injects detergent into the tub or into the drum to perform the washing course and the like. When the drum rotates in a state in which washing water and the detergent are supplied into the tub, the contaminants may be removed from the laundry via friction between the drum and the washing water.

[0006] The detergent supply device may have a detergent supply function to improve a washing effect. In this regard, the detergent may include all substances that enhance the washing effect, such as a washing agent that induces decomposition and removal of the contaminants, a softener that improves flexibility of fabrics of the laundry, and a bleach that reduces color contamination in the laundry. The detergent may include both powder and liquid forms.

[0007] In one example, to supply the detergent to the tub, means to form a flow of the detergent may be required. For example, a pump for the flow of detergent may be disposed in a detergent flow path.

[0008] However, the forming of the flow of the detergent using the pump consumes energy to operate the pump, consumes a space for placing the pump, and requires design requirements for connecting the pump.

[0009] In one example, when the detergent is provided directly into the drum and comes into direct contact with the laundry, the detergent in a concentrated form may have a negative effect on the laundry and cause discoloration or deformation of the laundry, so that a detergent

outlet or the like to provide the detergent mixed with water into the drum may be required.

[0010] In this regard, the detergent outlet refers to a component that receives the detergent and water, mixes them to each other in an internal space, and provides mixed solution of the detergent and water into the tub.

[0011] Inside the cabinet, the detergent outlet occupies a specific space and affects design of a flow path of the detergent and water. Therefore, omitting the detergent outlet may be advantageous in design of the laundry treating apparatus.

[0012] In addition, when the detergent remains in the flow path of the detergent, for example, the detergent outlet described above, after use of the laundry treating apparatus, functional/hygienic problems may be caused by sticking, adhesion, or the like of the detergent.

[0013] Furthermore, when different types of detergents are used, a clogging phenomenon in which a gel-type sticky substance is generated by a chemical reaction between the detergents may occur when mixing the detergents to each other. Therefore, when using the mixture of the different types of detergents, washing of the detergent becomes more important.

[Summary]

[Technical Problem]

[0014] Embodiments of the present disclosure are to provide a laundry treating apparatus that may allow detergent to flow efficiently to be used in a washing course.

[0015] Additionally, embodiments of the present disclosure are to provide a laundry treating apparatus that is efficient by minimizing energy consumption for flow of detergent.

[0016] Additionally, embodiments of the present disclosure are to provide a laundry treating apparatus that is advantageous in terms of space utilization and design by minimizing components required for supply of detergent.

[0017] Additionally, embodiments of the present disclosure are to provide a laundry treating apparatus that may effectively improve hygiene and manageability in use of detergent.

[0018] Additionally, embodiments of the present disclosure are to provide a laundry treating apparatus that may effectively wash and remove detergent from a flow path of the detergent.

[Technical Solutions]

[0019] An embodiment of the present disclosure may simultaneously inject detergent and a softener using a venturi tube without a reserve tank. A detergent cartridge and a softener cartridge may be installed in series with each other along a water supply pipe or installed in parallel with each other at one point.

[0020] Because a detergent supply pipe and the water

supply pipe are connected in series with each other, the detergent and the softener may be supplied at a high speed. Internal residual water may be removed by installing a check valve as a branch on a water supply hose.

[0021] An embodiment of the present disclosure may remove residual water in the water supply pipe using the check valve. As a main water supply valve opens, water supply to a venturi pump begins. When the water supply stops, a negative pressure may be momentarily created inside the water supply pipe because of inertia of a water flow. At this time, the negative pressure created may be resolved as outside air is supplied from the check, so that the residual water inside the water supply pipe may be discharged.

[0022] An embodiment of the present disclosure may constitute an efficient automatic detergent supply device without the reserve tank by adjusting design characteristics of the venturi pump. In addition, quick supply of the detergent and the softener becomes available by directly connecting the detergent and softener cartridges to the venturi pump.

[0023] In one example, a clogging phenomenon may be effectively prevented because the continuous water supply occurs after the detergent and the softener are sucked out, and a contamination-causing factor may be effectively removed by removing the residual water in the water supply pipe via the check valve located upstream of the water supply pipe.

[0024] An embodiment of the present disclosure as such provides a laundry treating apparatus including a cabinet, a tub disposed inside the cabinet and accommodating water therein, a drum disposed inside the tub and accommodating laundry therein, a water supply pipe disposed in the cabinet, wherein water supplied from an external water source flows through the water supply pipe, and a detergent pipe disposed in the cabinet, wherein detergent discharged from a detergent storage where the detergent is stored flows through the detergent pipe.

[0025] The water supply pipe includes a neck where a cross-sectional area thereof decreases and then increases again along a flow direction of water, and the detergent pipe is connected to the neck to provide the detergent into the water supply pipe via the neck.

[0026] The neck may be located downwardly of the detergent storage and connected to the detergent pipe. The laundry treating apparatus may further include a detergent outlet disposed in the cabinet, wherein the detergent outlet is connected to the water supply pipe downstream of the neck based on a flow of water to receive water and the detergent, wherein the detergent outlet discharges water and the detergent into the tub.

[0027] The water supply pipe may be connected to the tub and supply water and the detergent into the tub together.

[0028] The detergent storage may include a first detergent storage and a second detergent storage, the detergent pipe may include a first detergent pipe allowing

detergent discharged from the first detergent storage to flow therethrough, and a second detergent pipe allowing detergent discharged from the second detergent storage to flow therethrough, and the first detergent pipe and the second detergent pipe may be connected to the neck of the water supply pipe.

[0029] The detergent pipe may include a plurality of detergent pipes, and the plurality of detergent pipes may be spaced apart from each other along a longitudinal direction of the neck and connected to the neck.

[0030] The laundry treating apparatus may further include a plurality of detergent valves respectively connected to the plurality of detergent pipes to regulate detergent flows in the respective plurality of detergent pipes, and at least a portion of the neck may extend parallel to an arrangement direction of the plurality of detergent valves and may be connected to the plurality of detergent pipes.

[0031] The detergent pipe may include a plurality of detergent pipes, and the plurality of detergent pipes may be connected to points with the same water pressure inside the neck. The plurality of detergent pipes may be connected to the neck at the same location based on a longitudinal direction of the neck.

[0032] The laundry treating apparatus may further include a water supply valve connected to the water supply pipe to regulate a flow of water, and a pressure regulator that is connected to a point of the water supply pipe between the water supply valve and the neck, and regulates a pressure within the water supply pipe.

[0033] The pressure regulator may allow gas outside the water supply pipe to flow into the water supply pipe and block water inside the water supply pipe from flowing out of the water supply pipe, thereby resolving a negative pressure inside the water supply pipe.

[0034] The laundry treating apparatus may further include a detergent detector that is connected to a point of the water supply pipe downstream of the neck, and detects the detergent.

[0035] The detergent detector may include a pair of electrodes exposed into the water supply pipe.

[0036] The laundry treating apparatus may further include a controller that is connected in a signal manner to the detergent detector, and determines whether the detergent is mixed with water via a value measured by the pair of electrodes.

[Advantageous Effects]

[0037] The embodiments of the present disclosure may provide the laundry treating apparatus that may allow the detergent to flow efficiently to be used in the washing course.

[0038] Additionally, the embodiments of the present disclosure may provide the laundry treating apparatus that is efficient by minimizing the energy consumption for the flow of the detergent.

[0039] Additionally, the embodiments of the present disclosure may provide the laundry treating apparatus

that is advantageous in terms of the space utilization and the design by minimizing the components required for the supply of the detergent.

[0040] Additionally, the embodiments of the present disclosure may provide the laundry treating apparatus that may effectively improve the hygiene and the manageability in the use of the detergent.

[0041] Additionally, the embodiments of the present disclosure may provide the laundry treating apparatus that may effectively wash and remove the detergent from the flow path of the detergent.

[Brief Description of the Drawings]

[0042]

FIG. 1 is a perspective view of a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 2 is a cross-sectional view of a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 3 is a diagram showing a water supply pipe and a detergent pipe in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 4 is a diagram showing a neck formed in a water supply pipe in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 5 is a diagram showing a plurality of detergent pipes connected in series to a neck of a water supply pipe in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 6 is a diagram showing a plurality of detergent pipes connected in parallel to a neck of a water supply pipe in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 7 is a diagram showing a pressure regulator disposed on a water supply pipe in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 8 is a diagram showing a detergent detector disposed on a water supply pipe in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 9 is a graph comparing an opening time of a water supply valve with an opening time of a detergent valve in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 10 is a graph showing a change in an amount of detergent based on a viscosity of detergent and changes in a water pressure in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 11 is a graph showing a change in an amount of detergent based on a change in a water pressure with respect to low-viscosity detergent in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 12 is a graph showing a change in an amount of detergent based on a change in a water pressure with respect to high-viscosity detergent in a laundry treating apparatus according to an embodiment of the present disclosure.

FIG. 13 is a flowchart of a control method for a washing course in an embodiment of the present disclosure.

FIG. 14 is a flowchart of a control method for a detergent identifying step in an embodiment of the present disclosure.

[Best Mode]

[0043] Hereinafter, with reference to the attached drawings, embodiments of the present disclosure will be described in detail such that those skilled in the art may easily practice them.

[0044] However, the present disclosure may be implemented in several different forms and may not be limited to the embodiments described herein. Further, to clearly illustrate the present disclosure in the drawings, parts unrelated to the description are omitted, and similar drawing numerals are assigned to similar parts throughout the present document.

[0045] In the present document, redundant descriptions of the same components are omitted.

[0046] Further, in the present document, when a component is referred to as being 'connected' to another component, it should be understood that the components may be directly connected to each other, but there may be another component therebetween. On the other hand, in the present document, when a component is referred to as being 'directly connected' to another component, it should be understood that there is no other component therebetween.

[0047] Additionally, the terms used herein are merely used to describe specific embodiments and are not intended to limit the present disclosure.

[0048] Further, as used herein, singular expressions may include plural expressions, unless the context clearly dictates otherwise.

[0049] In addition, in the present document, it should be understood that terms such as 'include' or 'have' are only intended to indicate the presence of features, numbers, steps, operations, components, parts, or combinations thereof described herein, and do not preclude the presence or addition of other features, numbers, steps, operations, components, parts, or combinations thereof.

[0050] Further, in the present document, the term 'and/or' includes a combination of a plurality of listed items or any of the plurality of listed items. As used herein, 'A or B' may include 'A', 'B', or 'both A and B'.

[0051] FIG. 1 shows an outer appearance of a laundry treating apparatus 1 according to an embodiment of the present disclosure. Referring to FIG. 1, an embodiment of the present disclosure includes a cabinet 10.

[0052] The cabinet 10 forms an outer appearance of

the laundry treating apparatus 1. The cabinet 10 may be formed in various shapes, such as a square pillar shape, as well as another polygonal pillar shape or a circular pillar shape.

[0053] The cabinet 10 may be formed by coupling a plurality of panels to each other. For example, the cabinet 10 may include a front panel 11, a pair of side panels, a rear panel, a top panel 13, and a bottom panel, and the plurality of panels may establish a coupling relationship with each other or be molded integrally.

[0054] In an embodiment of the present disclosure, the cabinet 10 may include a laundry inlet 14 and may include a control panel 80.

[0055] The laundry inlet 14 is formed for a user to put laundry for treatment, such as washing, into the cabinet 10. FIG. 1 shows the laundry treating apparatus 1 of a top loading type in which the laundry inlet 14 is defined in the top surface panel 13, but an embodiment of the present disclosure is not necessarily limited to the top loading type, and the laundry treating apparatus 1 is able to be of a front loading type in which the laundry inlet 14 is defined in the front panel 11.

[0056] However, for convenience of description, unless otherwise specified, a description will be made below based on the embodiment of the top loading type in which the laundry inlet 14 is defined in the top panel 13 as shown in FIG. 1.

[0057] In one example, the cabinet 10 may have a laundry door 15. The laundry door 15 may be disposed on the cabinet 10 to open and close the laundry inlet 14. For example, the laundry door 15 may open and close the laundry inlet 14 by moving away from or approaching the top panel 13 in which the laundry inlet 14 is defined in a sliding or pivoting manner. When the laundry inlet 14 is defined in the front panel 11, it is natural that the laundry door 15 is also disposed on the front panel 11.

[0058] In one example, the control panel 80 serves as a means to inform the user of an operating state of the laundry treating apparatus 1 or to allow the user to input a manipulation signal. The control panel 80 may include an output unit that may provide visual information, auditory information, or the like to the user, and an input unit that is manipulated by the user to generate the manipulation signal.

[0059] In FIG. 1, the control panel 80 is shown installed on the top panel 13, but the present disclosure is not necessarily limited thereto. The control panel 80 may be disposed at various locations, such as on the front panel 11, as needed, and may include a plurality of control panels.

[0060] FIG. 2 shows a cross-section showing the interior of the laundry treating apparatus 1 according to an embodiment of the present disclosure. The cross-section in FIG. 2 corresponds to the interior of the laundry treating apparatus 1 as seen from the side.

[0061] Referring to FIG. 2, an embodiment of the present disclosure may include a tub 20, and the tub 20 may be disposed inside the cabinet 10 and accommodate

water therein. A space may be defined inside the tub 20, and water for the washing or the like of the laundry may be accommodated inside the tub 20.

[0062] The tub 20 may be formed in various shapes and may include a tub inlet 22 facing the laundry inlet 14. FIG. 2 shows the tub 20 having a top surface that is opened to define the tub inlet 22.

[0063] The tub 20 may include various components. For example, a pulsator may be disposed on a bottom surface of the tub 20 to form a water flow, and a vibration sensor to measure vibration, a water level sensor to measure a water level, a load sensor to measure a load, and the like may be disposed.

[0064] A drum 30 may be installed inside the tub 20. The drum 30 may be rotatably installed inside the tub 20. The drum 30 may be connected to a driving shaft of a driver 40 and may be rotated by receiving a rotational force.

[0065] The driver 40 may be disposed outside the tub 20. The driver 40 may include the driving shaft that extends through the tub 20, and the driving shaft may be connected to the drum 30 to rotate the drum 30.

[0066] The driver 40 may be located under the tub 20, and the driving shaft may protrude upward from the bottom surface of the tub 20 and be connected to a bottom surface of the drum 30. A top surface of the drum 30 may be opened to define a drum inlet 32.

[0067] The drum 30 may be formed in various shapes. The drum 30 may have a circular cross-section centered on a rotation axis for ease of rotation. A space may be defined inside the drum 30, and the laundry introduced via the laundry inlet 14 may be accommodated inside the drum 30.

[0068] In other words, the laundry input via the laundry inlet 14 of the cabinet 10 may be put into the drum 30 via the tub inlet 22 and the drum inlet 32. The laundry inlet 14, the tub inlet 22, and the drum inlet 32 may be aligned to face each other.

[0069] However, when the laundry inlet 14 is defined in the front panel 11, it is natural that the tub inlet 22 and the drum inlet 32 may face forward, the driving shaft may extend in a front and rear direction, and the driver 40 may be located under or at the rear of the tub 20.

[0070] In one example, an embodiment of the present disclosure may include an external water source 60 that is connected to a water source located outside, such as an urban water pipe, and receives water from the outside of the cabinet 10. The external water source 60 may include a water supply valve 150 to regulate a flow of water.

[0071] The water supply valve 150 may be embedded in the external water source 60 or may be disposed on a water supply pipe 100, which will be described later, outside the external water source 60. The water supply valve 150 may include a varying number of water supply valves as needed. The water supply valve 150 may be connected to the water supply pipe 100 and may regulate the flow of water provided to the water supply pipe 100.

[0072] In other words, opening the water supply valve

150 may allow the flow of water, and closing the water supply valve 150 may block the flow of water. The water supply valve 150 may be connected in an electrical/signal manner to a controller 50, which will be described later, and may be controlled in the opening and closing by the controller 50.

[0073] The water supply pipe 100 may be disposed in the cabinet 10, and water provided from the external water source 60 may flow therethrough. The water supply pipe 100 may become means of connecting the external water supply source 60 with the tub 20 or with a detergent outlet 400, which will be described later.

[0074] The water supply pipe 100 may include a varying number of water supply pipes as needed. At least one of the plurality of water supply pipes 100 may correspond to a direct water pipe 120 that is directly connected to the tub 20. When the water supply pipe 100 includes one or more water supply pipes, the water supply valve 150 may also include one or more water supply valves, but the number of water supply pipes 100 and the number of water supply valves 150 are not necessarily coincident with each other.

[0075] In one example, an embodiment of the present disclosure may further include a drainage 90, and the drainage 90 may be connected to the tub 20 to discharge water accommodated in the tub 20 to the outside of the cabinet 10. The drainage 90 may include a drain pump for forming the flow of water, and may include a drain valve for regulating the flow of water.

[0076] In one example, an embodiment of the present disclosure may include a detergent storage 70. The detergent storage 70 may be disposed in the cabinet 10 and may store detergent therein.

[0077] The detergent storage 70 may be installed on an outer side of the cabinet 10, or may be installed inside of the cabinet 10. The detergent storage 70 may be separated from the cabinet 10, or may be formed integrally so as not to be separated from the cabinet 10.

[0078] FIG. 2 schematically shows the detergent storage 70 disposed to be exposed to the outside at a top of the cabinet 10 according to an embodiment of the present disclosure, but the shape and the location of the detergent storage 70 are not necessarily limited thereto.

[0079] The detergent storage 70 may have a space defined therein, so that the detergent may be stored. In addition, the detergent storage 70 may include a plurality of detergent storages, so that different detergents may be stored. The detergent storage 70 may include a varying number of detergent storages as needed.

[0080] An embodiment of the present disclosure may include a detergent valve 250. The detergent valve 250 may be connected to the detergent storage 70 and may regulate a flow of the detergent discharged from the detergent storage 70.

[0081] When the detergent storage 70 includes one or more detergent storages, the detergent valve 250 may also include one or more detergent valves. The plurality of detergent valves 250 may regulate the flows of deter-

gents with respect to the plurality of detergent storages 70, respectively.

[0082] For example, the detergent storages 70 may include a first detergent storage and a second detergent storage, and the plurality of detergent valves 250 may include a first detergent valve 251 connected to the first detergent storage and a second detergent valve 252 connected to the second detergent storage.

[0083] The detergent storage 70 may be connected to a detergent pipe 200. The detergent pipe 200 may be disposed in the cabinet 10, and the detergent discharged from the detergent storage 70 where the detergent is stored may flow therethrough. The detergent pipe 200 may be disposed in the cabinet 10. The detergent pipe 200 may be located inside the cabinet 10, or at least a portion thereof may be exposed to the outside of the cabinet 10.

[0084] The detergent storage 70 may be directly connected to the detergent pipe 200 or indirectly connected to the detergent pipe 200 via the detergent valve 250. When the detergent storage 70 and the detergent pipe 200 are directly connected to each other, the detergent valve 250 may be installed on the detergent pipe 200.

[0085] The detergent discharged from the detergent storage 70 may flow along the detergent pipe 200. That is, the detergent pipe 200 may form at least a portion of the flow path of the detergent. The detergent discharged from the detergent storage 70 may flow along the detergent pipe 200 and the like and be provided into the tub 20 or the drum 30.

[0086] In one example, an embodiment of the present disclosure may include the detergent outlet 400. The detergent outlet 400 may be disposed in the cabinet 10, may be connected to the water supply pipe 100 to receive water and the detergent, and may discharge water and the detergent into the tub 20.

[0087] The detergent outlet 400 may be disposed inside the cabinet 10 or disposed to be exposed to the outside of the cabinet 10. The detergent outlet 400 may be connected to the water supply pipe 100 and the detergent pipe 200 as needed. A mixed solution of the detergent and water may exist inside the detergent outlet 400, and the mixed solution may be provided from the detergent outlet 400 into the tub 20 or the drum 30.

[0088] The detergent outlet 400 may provide water and the detergent into the tub 20 or the drum 30. The detergent outlet 400 may directly discharge water and the detergent into the tub 20 or the drum 30, or may supply water and the detergent into the tub 20 or the drum 30 via other components such as a flow pipe of the mixed solution.

[0089] In one example, an embodiment of the present disclosure may include the controller 50. The controller 50 may be connected in an electrical/signal manner not only to the control panel 80, but also various valves, sensors, and motors.

[0090] The controller 50 may transmit various signals to the user via the control panel 80 or receive the manip-

ulation signal from the user via the control panel 80. The controller 50 may adjust operating states of the various valves based on the manipulation signal of the user or pre-stored information.

[0091] FIG. 3 shows a diagram schematically showing a water supply structure and a detergent supply structure of an embodiment of the present disclosure. FIG. 3 schematically shows the plurality of detergent storages 70.

[0092] Referring to FIG. 3, an embodiment of the present disclosure may include the first detergent storage and the second detergent storage, and may include a first detergent pipe 201 through which the detergent discharged from the first detergent storage flows and a second detergent pipe 202 through which the detergent discharged from the second detergent storage flows. However, the numbers of detergent storages 70, detergent valves 250, and detergent pipes 200 may not be limited as shown in FIG. 3 and may vary as needed.

[0093] The detergent stored in the detergent storage 70 may flow along the detergent pipe 200 via the detergent valve 250. Water introduced into the cabinet 10 via the external water source 60 may flow along the water supply pipe 100 via the water supply valve 150. In FIG. 3, the flow path of water flowing along the water supply pipe 100 is indicated by arrows.

[0094] In FIG. 3, the detergent outlet 400 that receives water and the detergent is shown, and a direct water pipe 120 that directly connects the water supply valve 150 with the tub 20 is shown. However, as will be described later, the detergent outlet 400 and the direct water pipe 120 may be omitted when necessary.

[0095] FIG. 4 shows the water supply pipe 100 and the detergent pipe 200 connected to the water supply pipe 100 according to an embodiment of the present disclosure.

[0096] Referring to FIG. 4, water allowed to flow by the water supply valve 150 flows along the water supply pipe 100. A cross-sectional area of the water supply pipe 100 may decrease along a flow direction of water and then increase again to form a neck 110.

[0097] In the present disclosure, the neck 110 refers to an area of reduced flow cross-sectional area defined as a flow cross-sectional area of fluid decreases and then increases again.

[0098] Referring to FIG. 4, the neck 110 in which the cross-sectional area decreases and then increases again based on the flow direction of water indicated by the arrows may be formed in the water supply pipe 100. An upstream portion 108, which may be located adjacent to an upstream side of the neck 110, and a downstream portion 112, which may be located adjacent to a downstream side of the neck 110, may have cross-sectional areas larger than that of the neck 110, based on the flow direction of water.

[0099] In other words, the neck 110 may refer to a portion whose cross-sectional area is smaller than those of the upstream portion 108 and the downstream portion 112 adjacent thereto. A water pressure of the fluid flowing

through the water supply pipe 100 may be reduced because of the change in the cross-sectional area at the neck 110.

[0100] For example, water may create a lower water pressure in the neck 110 than in the upstream portion 108 and the downstream portion 112. Water may create a negative pressure in the neck 110 relative to the upstream portion 108 and the downstream portion 112.

[0101] In an embodiment of the present disclosure, the detergent discharged from the detergent storage 70 may flow along the detergent pipe 200 while being allowed to flow by the detergent valve 250. The detergent pipe 200 may be connected to the neck 110 of the water supply pipe 100.

[0102] As the detergent pipe 200 is connected to the neck 110, the water pressure created in the neck 110 may be transmitted into the detergent pipe 200. In other words, the detergent pipe 200 connected to the neck 110 makes it easy for the detergent to flow into the water supply pipe 100 because of the low water pressure created in the neck 110.

[0103] For example, when a detergent pump for the flow of the detergent is disposed, when the detergent pipe 200 connects the detergent valve 250 with the neck 110 of the water supply pipe 100, power required to introduce the detergent into the water supply pipe 100 may be greatly reduced.

[0104] In addition, by adjusting a diameter of the upstream portion 108, a diameter of the neck 110, and the like in the water supply pipe 100 in terms of design, the negative pressure may be created in the neck 110 relative to an internal pressure created in the detergent pipe 200. In this case, it is advantageous because the detergent may flow into the water supply pipe 100 and be provided into the tub 20 together with water even when an apparatus that consumes power to allow the detergent to flow, such as the detergent pump, is removed.

[0105] In an embodiment of the present disclosure, the detergent pipe 200 is directly connected to the water supply pipe 100, so that the detergent may be supplied into the water supply pipe 100. Therefore, at least a portion of the flow path of the detergent toward the inside of the tub 20 overlaps the flow path of water, which is advantageous in cleaning remaining detergent.

[0106] Additionally, in an embodiment of the present disclosure, when the detergent pipe 200 is connected to the water supply pipe 100, a component such as the detergent outlet 400 for mixing the detergent with water before the detergent is supplied to the laundry may be eliminated.

[0107] When the component such as the detergent outlet 400 is eliminated, it is advantageous in design because a space inside the cabinet 10 may be secured, and it may also be advantageous in design of the water supply pipe 100 and the detergent pipe 200.

[0108] That is, in an embodiment of the present disclosure, the neck 110 is formed in the water supply pipe 100 through which water to be supplied to the tub 20 flows,

and the detergent pipe 200 extending from the detergent valve 250 is connected to the neck 110, so that the detergent may be effectively introduced into the water supply pipe 100 using the change in the water pressure, the component for mixing the detergent with water may be eliminated, and the remaining detergent existing on the flow path of the detergent may be effectively cleaned.

[0109] Referring to FIGS. 2 and 3, in an embodiment of the present disclosure, the neck 110 may be located downwardly of the detergent storage 70 and connected to the detergent pipe 200.

[0110] When the neck 110 is located downwardly of the detergent storage 70, a self-weight of the detergent may contribute to the flow of the detergent, and thus an inflow performance of the detergent into the water supply pipe 100 may be effectively improved.

[0111] In one example, as described above, an embodiment of the present disclosure may include the detergent outlet 400 that is disposed in the cabinet 10, is connected to the water supply pipe 100 to receive water and the detergent, and discharges water and the detergent to the tub 20.

[0112] In other words, in the state in which the neck 110 and the detergent pipe 200 are connected to each other, the water supply pipe 100 may be connected to the detergent outlet 400 on a downstream side of the neck 110. Accordingly, the detergent outlet 400 may receive water and the detergent together via the water supply pipe 100, and the remaining detergent may be effectively removed even without separately cleaning the detergent inside.

[0113] The detergent outlet 400 may discharge both water and the detergent supplied via the water supply pipe 100 into the drum 30. The detergent outlet 400 may be located upwardly of the drum 30 and may discharge water and the detergent into the drum inlet 32, and water and the detergent may fall by their self-weights and be supplied into the drum 30.

[0114] As described above, an embodiment of the present disclosure may include the direct water pipe 120. That is, in an embodiment of the present disclosure, the water supply pipe 100 may be connected to the tub 20 and may supply water and the detergent into the tub 20 together.

[0115] For example, the water supply pipe 100 may correspond to the above-described direct water pipe 120, and the neck 110 may be formed in the direct water pipe 120 to be connected to the detergent pipe 200, so that water and the detergent may be provided directly into the tub 20 or the drum 30 while an intermediate component such as the detergent outlet 400 is eliminated.

[0116] FIGS. 5 and 6 show the plurality of detergent pipes 200 connected to the neck 110 of the water supply pipe 100. As described above, an embodiment of the present disclosure may include the plurality of detergent storages 70 as needed.

[0117] For example, in an embodiment of the present disclosure, the detergent storages 70 may include the

first detergent storage and the second detergent storage, and the detergent pipe 200 may include the first detergent pipe 201 through which the detergent discharged from the first detergent storage flows and the second detergent pipe 202 through which the detergent discharged from the second detergent storage flows.

[0118] When there are the plurality of detergent pipes 200 as described above, in an embodiment of the present disclosure, the first detergent pipe 201 and the second detergent pipe 202 may be connected to the neck 110 of the water supply pipe 100. Accordingly, the detergents from the plurality of detergent storages 70 may all be provided into the drum 30 by being introduced into the water supply pipe 100 based on the change in the water pressure, and the remaining detergent may be cleaned by water flowing through the water supply pipe 100.

[0119] Referring to FIG. 5, in an embodiment of the present disclosure, the plurality of detergent pipes 200 may be spaced apart from each other along a longitudinal direction of the neck 110 and connected to the neck 110. In this case, different negative pressures may be created in the plurality of detergent pipes 200 depending on connection locations thereof, so that detergent inflow amounts thereof may be set differently.

[0120] Accordingly, amounts of detergents used in the first detergent storage and the second detergent storage may be effectively set differently as needed.

[0121] Unlike the above, in an embodiment of the present disclosure, the diameter of the neck 110 may change along the flow direction of water, so that by creating the same water pressure at points spaced apart from each other along the flow direction of water, the same water pressure may be provided to the plurality of detergent pipes 200 while effectively increasing an installation area where the plurality of detergent pipes 200 are installed.

[0122] In one example, an embodiment of the present disclosure may include the plurality of detergent valves 250 as described above, and at least a portion of the neck 110 may extend parallel to an arrangement direction of the plurality of detergent valves 250 and may be connected to the plurality of detergent pipes 200.

[0123] For example, the neck 110 of the water supply pipe 100 may be located adjacent to the plurality of detergent valves 250 and extend in parallel with the plurality of detergent valves 250, for example, the first detergent valve 251 and the second detergent valve 252. Accordingly, a length of the detergent pipe 200 for connecting the neck 110 with the detergent valve 250 may be effectively reduced, thereby effectively reducing an area in which the detergent may remain, and conveniently connecting the plurality of detergent valves 250 with the neck 110.

[0124] Referring to FIG. 6, in an embodiment of the present disclosure, the plurality of detergent pipes 200 may be connected to the neck 110 at the same location based on the longitudinal direction of the neck 110.

[0125] In FIG. 6, the first detergent pipe 201 connected

to the first detergent valve 251 and the second detergent pipe 202 connected to the second detergent valve 252 are shown connected to the neck 110 at the same location based on the flow direction of water.

[0126] Accordingly, the same negative pressure is transmitted to the first detergent pipe 201 and the second detergent pipe 202, making it easy to manage the amounts of detergents equally.

[0127] However, as described above, even when the first detergent pipe 201 and the second detergent pipe 202 are connected to the neck 110 at the different locations, the plurality of detergent pipes 200 may be connected to the points where the water pressures inside the neck 110 are the same.

[0128] In other words, an embodiment of the present disclosure may adjust the design of the neck 110 and variously adjust the connection points of the first detergent pipe 201 and the second detergent pipe 202 as needed, thereby adjusting the water pressures applied to the first detergent pipe 201 and the second detergent pipe 202 and effectively adjusting the amount of each detergent introduced into the water supply pipe 100.

[0129] FIG. 7 shows a pressure regulator 270 disposed on the water supply pipe 100 according to an embodiment of the present disclosure.

[0130] Referring to FIG. 7, an embodiment of the present disclosure may include the pressure regulator 270 connected to a point between the water supply valve 150 and the neck 110 of the water supply pipe 100 and regulating a pressure within the water supply pipe 100.

[0131] The pressure regulator 270 may be disposed on the water supply pipe 100 and may compensate for the change in the water pressure inside the water supply pipe 100. For example, the pressure regulator 270 may relieve the negative pressure created inside the water supply pipe 100.

[0132] Specifically, in a situation in which the water supply valve 150 is opened and water flows along the water supply pipe 100, when a water supply process of providing water to the tub 20 is ended, a state of the water supply valve 150 may be switched to a closed state by the controller 50.

[0133] In this case, the negative pressure may be created within the water supply pipe 100 when the water supply valve 150 is closed, because of inertia of water discharged on an opposite side of the water supply valve 150. For example, the negative pressure may be created because of the inertia of flowing water in a portion adjacent to the water supply valve 150 inside the water supply pipe 100 in the state in which the water supply valve 150 is closed.

[0134] As described above, the negative pressure created within the water supply pipe 100 may prevent water from being discharged from the water supply pipe 100 even when the water supply process is completed, and thus residual water may be generated inside the water supply pipe 100.

[0135] Furthermore, when the detergent pipe 200 is

connected to the water supply pipe 100 to provide the detergent into the water supply pipe 100, the negative pressure generated when the water supply valve 150 is closed suppresses the discharge of the detergent along with water as described above, so that internal hygiene and manageability of the water supply pipe 100 may be reduced.

[0136] Accordingly, an embodiment of the present disclosure may include the pressure regulator 270 on the water supply pipe 100 and may effectively resolve the flow inertia of water when the water supply valve 150 is closed and the negative pressure created by the closure of the water supply valve 150, thereby effectively suppressing the situation in which water and the detergent remain inside the water supply pipe 100.

[0137] The location of the pressure regulator 270 on the water supply pipe 100 may vary. In an embodiment of the present disclosure, to effectively prevent the residual detergent via the pressure regulator 270, the pressure regulator 270 may be located upstream of the detergent pipe 200 or the neck 110 based on the flow direction of water.

[0138] That is, the pressure regulator 270 may be connected to the water supply pipe 100 at the point between the water supply valve 150 and the neck 110. Furthermore, the pressure regulator 270 may be located adjacent to the water supply valve 150 to maximize the effect of removing residual water via relieving the negative pressure.

[0139] In an embodiment of the present disclosure, the pressure regulator 270 may allow gas outside the water supply pipe 100 to flow into the water supply pipe 100, and block water inside the water supply pipe 100 from being discharged to the outside of the water supply pipe 100, thereby resolving the negative pressure within the water supply pipe 100.

[0140] For example, the pressure regulator 270 may be formed as a type of check valve and may allow only one-way flow of the fluid. That is, in an embodiment of the present disclosure, the pressure regulator 270 may block the fluid from flowing from the inside to the outside of the water supply pipe 100 and may allow the fluid to flow from the outside to the inside of the water supply pipe 100.

[0141] Accordingly, although water flowing with a predetermined water pressure within the water supply pipe 100 as the water supply valve 150 is opened is not able to be discharged out of the water supply pipe 100 via the pressure regulator 270, air outside the water supply pipe 100 may be introduced into the water supply pipe 100 via the pressure regulator 270 when the water supply valve 150 is closed and a temporary negative pressure is created, thereby effectively relieving the negative pressure inside the water supply pipe 100.

[0142] FIG. 8 shows a detergent detector 300 installed on the water supply pipe 100 according to an embodiment of the present disclosure.

[0143] Referring to FIG. 8, an embodiment of the

present disclosure may include the detergent detector 300. The detergent detector 300 may be connected to a point of the water supply pipe 100 downstream of the neck 110 and detect the detergent.

[0144] The detergent detector 300 may be of various types, and the location and the number thereof may be changed variously as needed.

[0145] In an embodiment of the present disclosure, the detergent may be introduced into the water supply pipe 100, and accordingly, the detergent detector 300 that may detect presence or absence of the detergent may be installed on the water supply pipe 100. When the detergent detector 300 is installed on the water supply pipe 100, the detergent detector 300 may be cleaned at all times by water flowing through the water supply pipe 100, which is advantageous for management.

[0146] In addition, when there are the plurality of detergent storages 70 and the plurality of detergent pipes 200, even when the detergent detector 300 is not disposed on each detergent storage 70 or each detergent pipe 200, whether the detergents of the plurality of detergent storages 70 are exhausted may be effectively identified via the detergent detector 300 located downstream of the neck 110.

[0147] In addition, the controller 50 may adjust an amount of detergent input by identifying a viscosity and the like of the detergent using a detected value of the detergent detector 300, which will be described in detail later.

[0148] In an embodiment of the present disclosure, the detergent detector 300 may include a pair of electrodes 310 exposed into the water supply pipe 100. That is, the detergent detector 300 may include an electrode 310 sensor. The detergent detector 300 may correspond to the electrode 310 sensor.

[0149] In an embodiment of the present disclosure, the detergent detector 300 may detect whether the detergent is in contact based on a change in a current value and the like via the contact between the electrode 310 and the detergent. In one example, because the pair of electrodes 310 are exposed to water inside the water supply pipe 100, they may be cleaned by water flowing along the water supply pipe 100.

[0150] The controller 50 may be connected in a signal manner to the detergent detector 300 and may determine whether water and the detergent are mixed with each other via a value measured by the pair of electrodes 310.

[0151] A detected value of the detergent detector 300 in the state in which water flows in the water supply pipe 100 may be different from a detected value in the state in which water and the detergent flow together in the water supply pipe 100. For example, the current values or resistance values of the detergent detector 300 may be measured differently because of differences in components for when water excluding the detergent is detected by the detergent detector 300 and when the detergent and water are mixed together and the mixture is detected by the detergent detector 300.

[0152] Accordingly, the controller 50 may not only detect the detergent when water does not exist in the water supply pipe 100, but also may effectively identify the presence or the absence of the detergent even in the situation in which water flows.

[0153] A detailed description on the detection of the detergent via the detergent detector 300 in an embodiment of the present disclosure will be made as follows.

[0154] First, an embodiment of the present disclosure may include the cabinet 10, the tub 20, and the drum 30, as described above, and may include the detergent storage 70 in which the detergent is stored. In addition, an embodiment of the present disclosure may include the detergent valve 250 that is disposed on the flow path of the detergent discharged from the detergent storage 70 and regulates the flow of the detergent.

[0155] In this regard, the flow path of the detergent refers to the path along which the detergent discharged from the detergent storage 70 flows in the process of reaching the interior of the drum 30. The aforementioned water supply pipe 100 and detergent pipe 200 may define at least a portion of the flow path of the detergent.

[0156] In an embodiment of the present disclosure, the detergent valve 250 may be disposed on the flow path of the detergent and may regulate the flow of the detergent. In one example, the detergent detector 300 may be located on the flow path of the detergent downstream of the detergent valve 250 and detect the detergent.

[0157] For example, in an embodiment of the present disclosure, the detergent detector 300 may be located at a point corresponding to the flow path of the detergent, such as the detergent pipe 200, the water supply pipe 100, and the detergent outlet 400 described above, and may detect the detergent.

[0158] In one example, as described above, the detergent storage 70 may include the plurality of detergent storages, and the detergent valve 250 may also include the plurality of detergent valves to regulate the flows of the detergents of the plurality of detergent storages 70, respectively.

[0159] In this case, the flow path of the detergent may include an integrated path through which the detergent flows as individual paths respectively corresponding to the plurality of detergent storages 70 are integrated, and the detergent detector 300 may be disposed on the integrated path.

[0160] For example, the plurality of detergent pipes 200 respectively corresponding to the plurality of detergent storages 70 may correspond to the respective individual paths in the flow path of the detergent. When the plurality of detergent pipes 200 are connected to the water supply pipe 100, a side downstream of the points where the plurality of detergent pipes 200 are connected to the water supply pipe 100 may correspond to the integrated path in the flow path of the detergent.

[0161] In other words, in an embodiment of the present disclosure, when the plurality of detergents are used, the detergent detector 300 is disposed on the integrated path

in which the individual paths of the detergents are integrated, so that the plurality of detergents may be efficiently detected via the detergent detector 300 even when the plurality of detergent storages 70 and the plurality of detergent pipes 200 are arranged.

[0162] In an embodiment of the present disclosure, the controller 50 may utilize the detected value measured via the detergent detector 300 in various ways in the detergent supply process. For example, when the detergent is not detected by the detergent detector 300 during the detergent supply process, the controller 50 may inform the user that the detergent needs to be replenished.

[0163] In addition, the controller 50 may identify detergent characteristics based on the detected value of the detergent detector 300 and perform the detergent supply process in a corrected manner based on the detergent characteristics. The correction of the detergent supply process will be described with reference to FIG. 9 as follows.

[0164] FIG. 9 is a graph comparing an opening time of the water supply valve 150 with an opening time of the detergent valve 250 in a detergent supply process performed in an embodiment of the present disclosure. A in FIG. 9 indicates the opening of the water supply valve over time, and B indicates the opening of the detergent valve over time.

[0165] Referring to FIG. 9, in an embodiment of the present disclosure, the opening of the detergent valve 250 is performed in the open state of the water supply valve 150, so that the detergent may be supplied into the tub 20 or the drum 30 during the process of supplying water into the tub 20.

[0166] In an embodiment of the present disclosure, by adjusting an opening time TB of the detergent valve 250 relative to an opening time TA of the water supply valve 150 based on a preset unit time, the amount of detergent input may be adjusted.

[0167] It is shown in FIG. 9 that the water supply valve 150 is opened throughout the unit time to continuously supply water to the tub 20, and the opening time TB of the detergent valve 250 is set smaller than the unit time and the opening time TA of the water supply valve 150.

[0168] As described above, in an embodiment of the present disclosure, the controller 50 may correct the opening time TB of the detergent valve 250 based on the detergent characteristics, so that a correct amount of detergent may be effectively injected into the drum 30 during the process of performing the washing course of the laundry.

[0169] In one example, the controller 50 may be connected in a signal manner to the detergent detector 300 and the detergent valve 250, and may determine the viscosity of the detergent via an elapsed time for the detergent to be detected by the detergent detector 300 after opening the detergent valve 250.

[0170] Referring again to FIG. 8, the detergent detector 300 may be installed at the point of the water supply pipe 100, and a flow distance from the detergent valve 250

may be determined by design based on the flow path of the detergent.

[0171] When the viscosity of the detergent is high, fluidity may be reduced and thus an elapsed time to reach the detergent detector 300 from the detergent valve 250 may increase. Further, when the viscosity is low, the fluidity may be improved and thus the elapsed time may be reduced.

[0172] Accordingly, in an embodiment of the present disclosure, the controller 50 may identify the viscosity of the detergent based on an elapsed time from a time the detergent valve 250 in the closed state is switched to the open state to a time the detergent is detected by the detergent detector 300.

[0173] Matching of the elapsed time and the viscosity of the detergent may be performed based on a data map determined experimentally or statistically in advance, or the controller 50 may directly derive the viscosity of the detergent via a calculation formula using the elapsed time as a variable.

[0174] By adjusting the opening time of the detergent valve 250 based on the viscosity of the detergent, the controller 50 may provide the correct amount of detergent into the drum 30 despite a change in a type of detergent or an environmental change such as a temperature.

[0175] Specifically, the viscosity of the detergent affects an amount of detergent discharged for the same opening time of the detergent valve 250. For example, when the viscosity of the detergent is high, the amount of detergent provided to the water supply pipe 100 or the like for the same opening time of the detergent valve 250 may be reduced, and when the viscosity of the detergent is low, the amount of detergent provided for the same opening time of the detergent valve 250 may be increased.

[0176] FIG. 10 is a graph showing a change in an amount of detergent based on a change in a viscosity of detergent. In FIG. 10, detergents are indicated from (1) to (5) on a horizontal axis in an ascending order of viscosity, and an area C corresponding to the case in which the water pressure of the water supply pipe 100 is low and an area D corresponding to the case in which the water pressure is high are divided from each other based on a vertical dotted line.

[0177] A vertical axis corresponds to an amount of detergent Q discharged from the detergent storage 70 or the detergent valve 250. In the graph in FIG. 10, the amounts of detergent Q measured via two experiments at each specific value on the horizontal axis are written.

[0178] Referring to FIG. 10, it may be seen that as the viscosity of the detergent increases from (1) to (5), the amount of detergent provided at the same water pressure decreases.

[0179] FIG. 11 shows a graph showing a change in the amount of detergent Q based on a change in a water pressure with respect to low-viscosity detergent E, and FIG. 12 shows a graph showing a change in the amount of detergent Q based on a change in a water pressure

with respect to high-viscosity detergent F.

[0180] In FIGS. 11 and 12, the low-viscosity detergent E and the high-viscosity detergent F are defined in a relative relationship therebetween, a horizontal axis represents a progress time, and a vertical axis represents the amount of detergent Q.

[0181] Data values indicated on the graph are indicated in different shapes depending on the pressures of water flowing through the water supply pipe 100, and a dotted line connecting data values of the same or similar water pressures is indicated on the graph.

[0182] When comparing the graph in FIG. 11 targeting the low-viscosity detergent E with the graph in FIG. 12 targeting the high-viscosity detergent F, it may be seen that an increase amount of the amount of detergent Q in the graph targeting the low-viscosity detergent E is greater than an increase amount of the amount of detergent Q in the graph targeting the high-viscosity detergent F.

[0183] In other words, as may be seen in FIGS. 10 to 12, as the viscosity of the detergent increases, the amount of detergent Q provided to the water supply pipe 100 or the like decreases. Therefore, an embodiment of the present disclosure may effectively adjust the amount of detergent Q required for the washing course by correcting the opening time of the detergent valve 250 based on the viscosity of the detergent identified via the detergent detector 300.

[0184] In an embodiment of the present disclosure, the controller 50 may determine that the detergent is insufficient in the detergent storage 70 when a delay time for which the detergent is not detected by the detergent detector 300 after opening the detergent valve 250 exceeds a preset allowable time.

[0185] Specifically, in an embodiment of the present disclosure, the controller 50 may store in advance the allowable time for the delay time it takes for the detergent to be detected by the detergent detector 300, and the controller 50 may determine that the detergent does not exist or is insufficient in the detergent storage 70 when the delay time exceeds the allowable time.

[0186] Accordingly, the controller 50 may perform a detergent replenishment notification process of notifying the user that the detergent replenishment is necessary based on the detected value of the detergent detector 300 and the delay time.

[0187] In an embodiment of the present disclosure, a viscosity identifying process of identifying the viscosity of the detergent may be performed in advance before performing the detergent supply process in which the detergent is supplied into the tub 20 to perform the washing course or the like.

[0188] FIG. 13 shows a control method for a washing course of the laundry treating apparatus 1 according to an embodiment of the present disclosure. The viscosity identifying process will be described with reference to FIG. 13 as follows.

[0189] First, in the control method of the laundry treating apparatus 1 according to an embodiment of the

present disclosure, a laundry characteristic identifying step (S100) may be performed to perform the washing course or the like. In the laundry characteristic identifying step (S100), the controller 50 may identify a laundry material or a laundry amount via rotation characteristics of the drum 30.

[0190] After the laundry characteristic identifying step (S100), a detergent identifying step (S200) may be performed. In the detergent identifying step (S200), the controller 50 may perform the viscosity identifying process, the detergent replenishment notification process, and the like described above.

[0191] After the detergent identifying step (S200), a water supply step (S300) and a detergent supply step (S400) may be performed. In the flowchart in FIG. 13, it is represented that the detergent supply step (S400) is performed after the water supply step (S300), but the present disclosure is not necessarily limited thereto, and the water supply step (S300) and the detergent supply step (S400) are able to be performed simultaneously.

[0192] In the water supply step (S300), the controller 50 may open the water supply valve 150 to perform the water supply process of supplying water into the tub 20, and in the detergent supply step (S400), the controller 50 may open the detergent valve 250 to perform the detergent supply process of supplying the detergent.

[0193] The controller 50 may perform the viscosity identifying process via the detergent identifying step (S200) before performing the detergent supply process, thereby correcting the opening time of the detergent valve 250 based on the viscosity of the detergent and performing the detergent supply process.

[0194] In addition, as described above, in an embodiment of the present disclosure, the controller 50 may perform the viscosity identifying process of identifying the viscosity of the detergent via the elapsed time before performing the detergent supply process of supplying the detergent into the tub 20.

[0195] The elapsed time and the viscosity of the detergent may have a proportional relationship. For example, detergent with a great elapsed time may be identified as having a relatively high viscosity.

[0196] In one example, as described above, the controller 50 may perform the detergent supply process of supplying the detergent into the tub 20, and may increase the opening time of the detergent valve 250 as the viscosity of the detergent increases in the detergent supply process.

[0197] As described above, an embodiment of the present disclosure may include the water supply pipe 100 and the detergent pipe 200, and the water supply pipe 100 and the detergent pipe 200 may together form at least a portion of the flow path of the detergent.

[0198] That is, in an embodiment of the present disclosure, the detergent flowing from the detergent valve 250 may flow through the detergent pipe 200 and at least a portion of the water supply pipe 100 and be transferred into the tub 20. Additionally, as described above, the de-

tergent detector 300 may be located on the water supply pipe 100 downstream of the detergent pipe 200.

[0199] Furthermore, when the water supply pipe 100 or the detergent pipe 200 is connected to the detergent outlet 400 described above, the detergent detector 300 may be disposed on the detergent outlet 400 as well as on the water supply pipe 100. However, as described above, when the detergent outlet 400 or the like is eliminated and the water supply pipe 100 directly supplies water into the tub 20, it is natural that the detergent detector 300 is installed on the water supply pipe 100.

[0200] In one example, the viscosity identifying process of the detergent described above may be performed in the closed state of the water supply valve 150. When the water supply valve 150 is closed, there is no water in the water supply pipe 100, so that accuracy of the measurement of the elapsed time based on the flow of the detergent and the identification of the viscosity of the detergent resulted therefrom may be improved.

[0201] In an embodiment of the present disclosure, when the detected value of the detergent detector 300 is in an abnormal state before performing the viscosity identifying process, the controller 50 may close the detergent valve 250 and open the water supply valve 150 to perform a cleaning process of cleaning the detergent detector 300.

[0202] For example, when the detected value of the detergent detector 300 before the opening of the detergent valve 250 is received as indicating that the detergent is present, the controller 50 may determine that the detergent detector 300 is in the abnormal state, and perform the cleaning process of the detergent detector 300 via the opening of the water supply valve 150 before performing the viscosity identifying process.

[0203] After the cleaning process, the controller 50 may identify whether the detected value of the detergent detector 300 is in a normal state again, and, when the detected value is still identified to be in the abnormal state even after the cleaning process, may perform the cleaning process a plurality of times. When the cleaning process is performed a preset number of times or more, the controller 50 may perform an abnormality notification process of notifying the user of the abnormal state of the detergent detector 300.

[0204] As described above, the detergent detector 300 may detect the detergent via the electrode 310 sensor including the pair of electrodes 310. In this case, when the measured value of the electrode 310 sensor is generated before the reaching of the detergent, the corresponding state may be identified as the abnormal state.

[0205] As described above, in an embodiment of the present disclosure, the controller 50 may perform the detergent supply process of supplying the detergent into the tub 20, and may increase the opening time of the detergent valve 250 as the viscosity of the detergent increases in the detergent supply process.

[0206] Furthermore, in an embodiment of the present disclosure, the controller 50 may increase the opening

time of the detergent valve 250 as the water pressure of the water supply pipe 100 increases. The correlation between the water pressure and the amount of detergent input will be described with reference to FIGS. 10 to 12 as follows.

[0207] In FIG. 10, left and right sides based on the dotted line on the horizontal axis show different water pressures.

[0208] In the graph in FIG. 10, the area C on the left side of the dotted line represents a low water pressure, and the area D on the right side of the dotted line represents a high water pressure. In this regard, the low water pressure and the high water pressure are defined in the relative relationship therebetween.

[0209] When comparing the area C with the area D in FIG. 10, it may be seen that the detergent amount in the area C is measured greater, and further, it may be seen that a rate of change in the amount of detergent based on the change in the viscosity of the detergent is reduced in the area D.

[0210] In other words, when the detergent is supplied via the water supply pipe 100, it may be seen that when the water pressure increases, the amount of detergent introduced into the water supply pipe 100 decreases, and further, the amount of change in the amount of detergent based on the change in the viscosity of the detergent decreases.

[0211] In FIGS. 11 and 12, a dotted line indicated by X roughly connects data values at the low water pressure, and a dotted line indicated by Y roughly connects data values at the high water pressure.

[0212] As may be seen in FIGS. 11 and 12, the amount of detergent Q of the Y-dotted line corresponding to the relatively high water pressure is smaller than the amount of detergent Q of the X-dotted line corresponding to the relatively low water pressure. Further, when comparing the results in FIG. 11 targeting the low-viscosity detergent E with the results in FIG. 12 targeting the high-viscosity detergent F, it may be seen that, in the case of the high-viscosity detergent, an amount of change in the amount of detergent Q based on the change in the water pressure is smaller than that of the low-viscosity detergent.

[0213] That is, in an embodiment of the present disclosure, when the detergent pipe 200 is connected to the water supply pipe 100 and the detergent is supplied to the water supply pipe 100, the controller 50 may correct the opening time of the detergent valve 250 based on the water pressure. For example, as the water pressure increases, the opening time of the detergent valve 250 may be increased.

[0214] In addition, as the water pressure increases, a correction amount of the opening time of the detergent valve 250 based on the change in the viscosity of the detergent may be reduced. For example, when necessary, the controller 50 may reduce the amount of increase in the opening time of the detergent valve 250 based on the increase in the viscosity of the detergent as the water pressure increases.

[0215] In one example, an embodiment of the present disclosure may include a water pressure measurer connected to the water supply pipe 100 to measure the pressure of water flowing through the water supply pipe 100. The water pressure measurer may be included in the external water source 60 or the water supply valve 150, or may be separately connected to the water supply pipe 100.

[0216] In one example, the controller 50 may derive the water pressure based on a change in a water level inside the tub 20, or may derive the water pressure based on a change in a load inside the tub 20.

[0217] Specifically, the water pressure may be converted to a total amount of water provided to the tub 20 within a certain time, and accordingly, the controller 50 may identify the water pressure from the change in the water level inside the tub 20. In this case, the tub 20 may be equipped with a water level sensor to measure the water level.

[0218] In addition, the water pressure may be converted into an amount of change in the load of the tub 20 within a certain time, and accordingly, the controller 50 may identify the water pressure from the change in the load inside the tub 20 that increases for the certain time during the water supply process. In this case, the tub 20 may be equipped with a load sensor for measuring the load.

[0219] In one example, the controller 50 may identify the water level inside the tub 20 based on the load of the tub 20 and identify the water pressure based on the water level identified as such.

[0220] Specifically, the controller 50 may identify a load of the laundry accommodated in the tub 20 before the water supply while identifying the laundry material, the laundry amount, and the like via the above-described laundry characteristic identifying process, and may derive the water level inside the tub 20 by making the change in the load inside the tub 20 that occurs during the water supply process correspond to an amount of water provided.

[0221] In such derivation process, the change in the load or the change in the water level is related to the water pressure, so that the controller 50 may derive the water pressure therefrom and use the water pressure in correcting the opening time of the detergent valve 250.

[0222] FIG. 13 shows a flowchart showing the detergent identifying step (S200) in FIG. 12 in more detail. That is, FIG. 13 shows a control method of the laundry treating apparatus 1 for performing the detergent identifying step (S200) as the control method of the laundry treating apparatus 1 according to an embodiment of the present disclosure.

[0223] Referring to FIG. 13, the control method of the laundry treating apparatus 1 according to an embodiment of the present disclosure may include a detergent valve opening step (S220), a detergent detection determining step (S230), and a detergent viscosity identifying step (S240).

[0224] In the detergent valve opening step (S220), the controller 50 may open the detergent valve 250, which regulates the flow of the detergent discharged from the detergent storage 70 in which the detergent is stored.

[0225] In the detergent detection determining step (S230), the controller 50 may determine whether the detergent is detected by the detergent detector 300, which is disposed at a distance downstream of the detergent valve 250 on the flow path of the detergent discharged from the detergent storage 70.

[0226] In the detergent viscosity identifying step (S240), the controller 50 may identify the viscosity of the detergent via the elapsed time for the detergent detector 300 to detect the detergent after the opening of the detergent valve 250 when the detergent is detected in the detergent detection determining step (S230).

[0227] In one example, the control method of the laundry treating apparatus 1 according to an embodiment of the present disclosure may include a delay time determining step (S231) and a detergent replenishment notification step (S232).

[0228] In the delay time determining step (S231), after the detergent detecting step, the controller 50 may determine whether the delay time during which the detergent is not detected by the detergent detector 300 after the opening of the detergent valve 250 exceeds the preset allowable time.

[0229] In the detergent replenishment notification step (S232), when it is determined in the delay time determining step (S231) that the delay time exceeds the allowable time, the controller 50 may request the detergent replenishment of the detergent storage 70.

[0230] The detergent viscosity identifying step (S240) may be performed when it is determined in the delay time determining step (S231) that the delay time is equal to or smaller than the allowable time.

[0231] In one example, an embodiment of the present disclosure may include a first normal state determining step (S210) and a cleaning step (S211).

[0232] In the first normal state determining step (S210), before the detergent valve opening step (S220), the controller 50 may determine whether the detected value of the detergent detector 300 is in the normal state.

[0233] In the cleaning step (S211), when it is determined in the first normal state determination step (S210) that the detected value is in the abnormal state, the controller 50 may open the water supply valve 150 that regulates the flow of water with the detergent valve 250 closed, thereby washing the detergent detector 300.

[0234] The detergent valve opening step (S220) may be performed when the detected value is determined to be in the normal state in the normal state determining step.

[0235] The control method of the laundry treating apparatus 1 according to an embodiment of the present disclosure will be described in detail with reference to FIG. 14 as follows.

[0236] First, the controller 50 may perform the first nor-

mal state determining step (S210). In the first normal state determining step (S210), the controller 50 may determine whether the detected value of the detergent detector 300 is in the normal state. The controller 50 may recognize a state in which the detergent detector 300 does not detect the detergent before the opening of the detergent valve 250 as the normal state.

[0237] In the first normal state determining step (S210), when the detergent detector 300 detects the abnormal state, that is, detects the detergent before the opening of the detergent valve 250, the controller 50 may perform the cleaning step (S211).

[0238] In the cleaning step (S211), the controller 50 may close the detergent valve 250 and open the water supply valve 150 to wash the water supply pipe 100 or the detergent detector 300 located on the flow path of water.

[0239] After the cleaning step (S211), the controller 50 may perform a second normal state determining step (S212). The controller 50 may determine whether the detergent detector 300 is in the normal state after the cleaning, and when the detected value of the detergent detector 300 is identified to be normal after the cleaning, the aforementioned detergent valve opening step (S220) may be performed.

[0240] When the detected value of the detergent detector 300 is still not in the normal state in the second normal state determining step (S212) even after performing the cleaning step (S211), the controller 50 may perform a number of cleaning cycles determining step (S213). In the number of cleaning cycles determining step (S213), the controller 50 may determine whether the current number of cleaning cycles exceeds a preset allowable number of cleaning cycles.

[0241] For example, when the cleaning step (S211) is performed, the controller 50 may count the number of cleaning cycles that have been executed and determine whether the counted number of cleaning cycles exceeds the allowable number of cleaning cycles.

[0242] When the counted number of cleaning cycles is equal to or smaller than the allowable number of cleaning cycles in the number of cleaning cycles determining step (S213), the controller 50 may perform the above-described cleaning step (S211) again, and when the counted number of cleaning cycles exceeds the allowable number of cleaning cycles, the controller 50 may perform an abnormality notification step (S214) of notifying the user of the abnormal state of the detergent detector 300.

[0243] In the abnormality notification step (S214), the controller 50 may transmit a signal notifying the user of the abnormality of the detergent detector 300 using the control panel 80 or the like described above.

[0244] In one example, when it is determined in the first normal state determining step (S210) or the second normal state determining step (S212) described above that the detergent detector 300 is in the normal state, the controller 50 may perform the detergent valve opening

step (S220)

[0245] In the detergent valve opening step (S220), the detergent valve 250 may be opened in the closed state of the water supply valve 150 to discharge the detergent, and the detergent may flow by a self-weight or other forces.

[0246] After the detergent valve opening step (S220), the controller 50 may perform the detergent detection determining step (S230). In the detergent detection determining step (S230), the controller 50 may determine whether the detergent is detected by the detergent detector 300.

[0247] When the detergent is not detected by the detergent detector 300 in the detergent detection determining step (S230), the controller 50 may perform the delay time determining step (S231). In the delay time determining step (S231), the controller 50 may determine whether the delay time to date since the detergent valve 250 was opened via the detergent valve opening step (S220) exceeds the preset allowable time.

[0248] When the delay time exceeds the allowable time in the delay time determining step (S231), the controller 50 may perform the detergent replenishment notification step (S232). In the detergent replenishment notification step (S232), the controller 50 may notify the user via the control panel 80 or the like that the detergent does not exist or is insufficient in the detergent storage 70.

[0249] When the delay time is equal to or smaller than the allowable time in the delay time determining step (S231), the controller 50 may perform the detergent detection determining step (S230) again. The delay time determining step (S231) and the detergent detection determining step (S230) may be performed simultaneously or may be performed repeatedly with a predetermined time gap.

[0250] When the detergent is detected by the detergent detector 300 in the detergent detection determining step (S230) described above, the controller 50 may identify an elapsed time from the time when the detergent valve 250 is opened in the detergent valve opening step (S220) to the time when the detergent is detected by the detergent detector 300, and perform the detergent viscosity identifying step (S240) of identifying the viscosity of the detergent from the elapsed time.

[0251] The relationship between the elapsed time and the viscosity of the detergent may be determined based on the predetermined data map or the calculation formula.

[0252] After the detergent viscosity identifying step (S240), the controller 50 may perform a water pressure identifying step (S250). In the water pressure identifying step (S250), the controller 50 may identify the pressure of water provided to the water supply pipe 100 via the above-described scheme.

[0253] After the water pressure identifying step (S250), the controller 50 may perform an opening time correcting step (S260). In the opening time correcting step (S260), the controller 50 may correct the opening time of the de-

tergent valve 250 for each unit time by reflecting the viscosity of the detergent identified in advance and/or the pressure of water.

[0254] Although the present disclosure is shown and described in relation to the specific embodiment, it will be obvious to those skilled in the art that the present disclosure may be improved and changed in various ways without departing from the technical spirit of the present disclosure provided by the following patent claims.

Claims

1. A laundry treating apparatus comprising:

a cabinet;
a tub disposed inside the cabinet and accommodating water therein;
a drum rotatably disposed inside the tub and accommodating laundry therein;
a water supply pipe disposed in the cabinet, wherein water supplied from an external water source flows through the water supply pipe; and
a detergent pipe disposed in the cabinet, wherein detergent discharged from a detergent storage where the detergent is stored flows through the detergent pipe,
wherein the water supply pipe includes a neck where a cross-sectional area thereof decreases and then increases again along a flow direction of water,
wherein the detergent pipe is connected to the neck to provide the detergent into the water supply pipe.

2. The laundry treating apparatus of claim 1, wherein the neck is located downwardly of the detergent storage and connected to the detergent pipe.

3. The laundry treating apparatus of claim 1, further comprising a detergent outlet disposed in the cabinet, wherein the detergent outlet is connected to the water supply pipe downstream of the neck based on a flow of water to receive water and the detergent, wherein the detergent outlet discharges water and the detergent into the tub.

4. The laundry treating apparatus of claim 1, wherein the water supply pipe is connected to the tub and supplies water and the detergent into the tub together.

5. The laundry treating apparatus of claim 1, wherein the detergent storage includes a first detergent storage and a second detergent storage,

wherein the detergent pipe includes:

a first detergent pipe allowing detergent discharged from the first detergent storage to flow therethrough; and
a second detergent pipe allowing detergent discharged from the second detergent storage to flow therethrough,

wherein the first detergent pipe and the second detergent pipe are connected to the neck of the water supply pipe.

6. The laundry treating apparatus of claim 1, wherein the detergent pipe includes a plurality of detergent pipes,
wherein the plurality of detergent pipes are spaced apart from each other along a longitudinal direction of the neck and connected to the neck.

7. The laundry treating apparatus of claim 6, further comprising a plurality of detergent valves respectively connected to the plurality of detergent pipes to regulate detergent flows in the respective plurality of detergent pipes,
wherein at least a portion of the neck extends parallel to an arrangement direction of the plurality of detergent valves and is connected to the plurality of detergent pipes.

8. The laundry treating apparatus of claim 1, wherein the detergent pipe includes a plurality of detergent pipes,
wherein the plurality of detergent pipes are connected to points with the same water pressure inside the neck.

9. The laundry treating apparatus of claim 8, wherein the plurality of detergent pipes are connected to the neck at the same location based on a longitudinal direction of the neck.

10. The laundry treating apparatus of claim 1, further comprising:

a water supply valve connected to the water supply pipe to regulate a flow of water; and
a pressure regulator connected to a point of the water supply pipe between the water supply valve and the neck, and configured to regulate a pressure within the water supply pipe.

11. The laundry treating apparatus of claim 10, wherein the pressure regulator allows gas outside the water supply pipe to flow into the water supply pipe and blocks water inside the water supply pipe from flowing out of the water supply pipe, thereby resolving a negative pressure inside the water supply pipe.

12. The laundry treating apparatus of claim 1, further

comprising a detergent detector connected to a point of the water supply pipe downstream of the neck, and configured to detect the detergent.

13. The laundry treating apparatus of claim 12, wherein the detergent detector includes a pair of electrodes exposed into the water supply pipe. 5
14. The laundry treating apparatus of claim 13, further comprising a controller connected in a signal manner to the detergent detector, and configured to determine whether the detergent is present via a value measured by the pair of electrodes. 10

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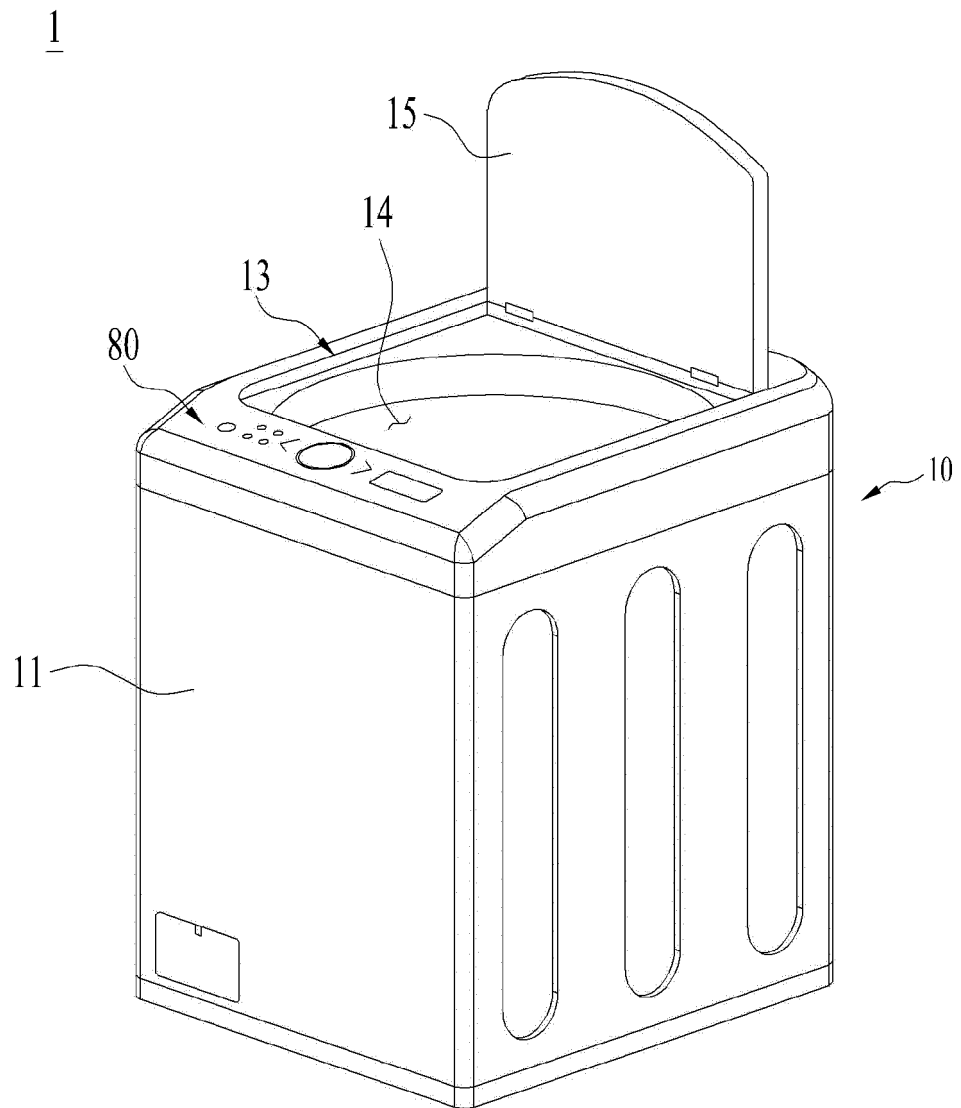
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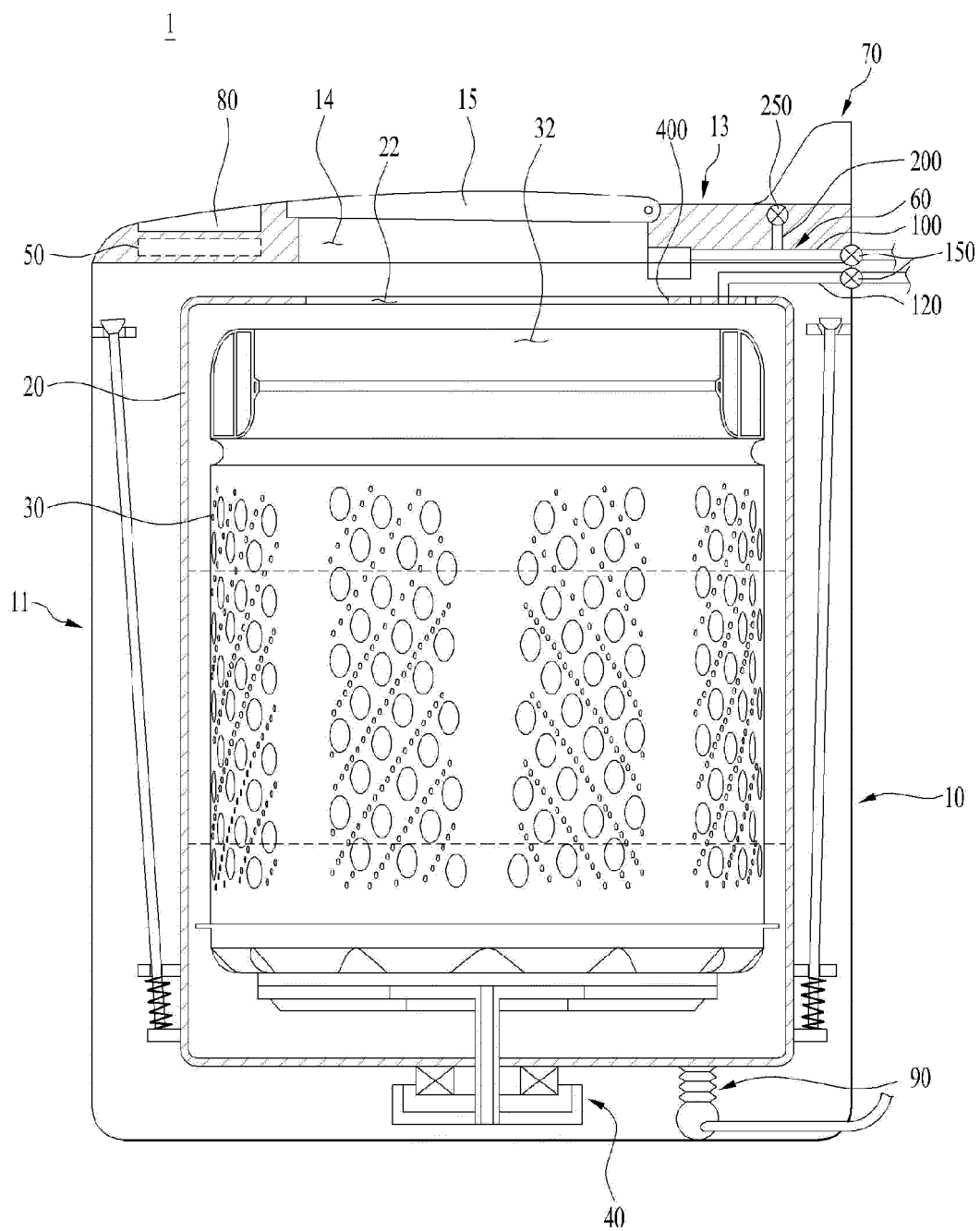
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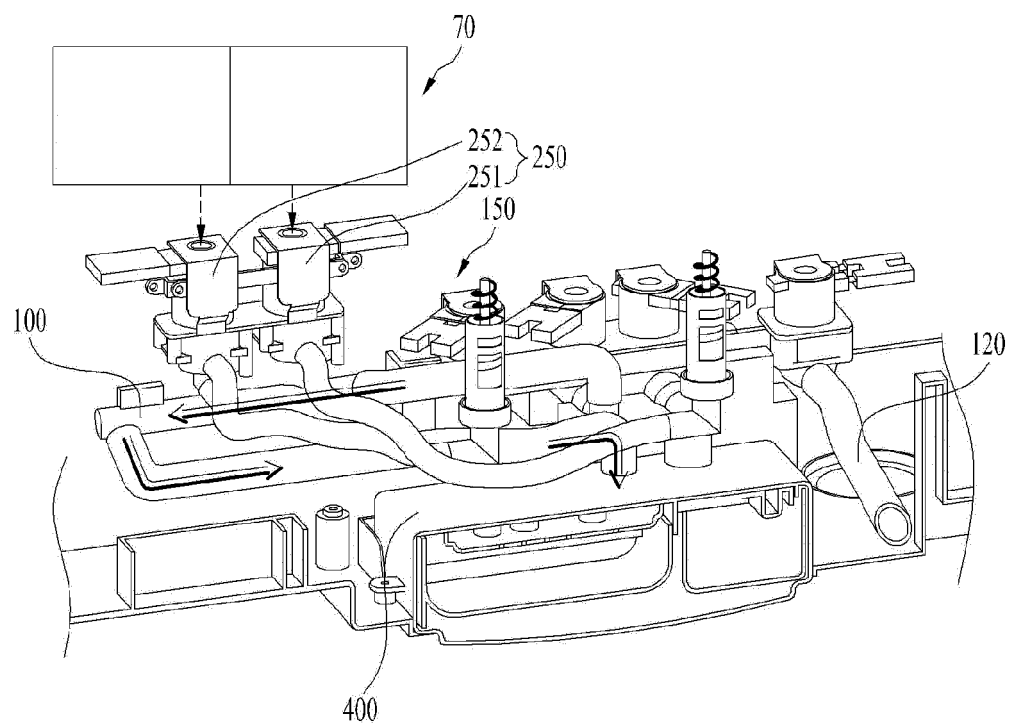
【FIG. 1】



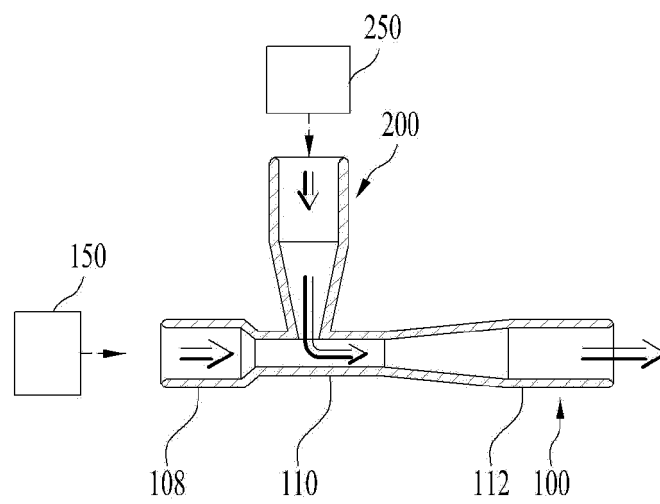
【FIG. 2】



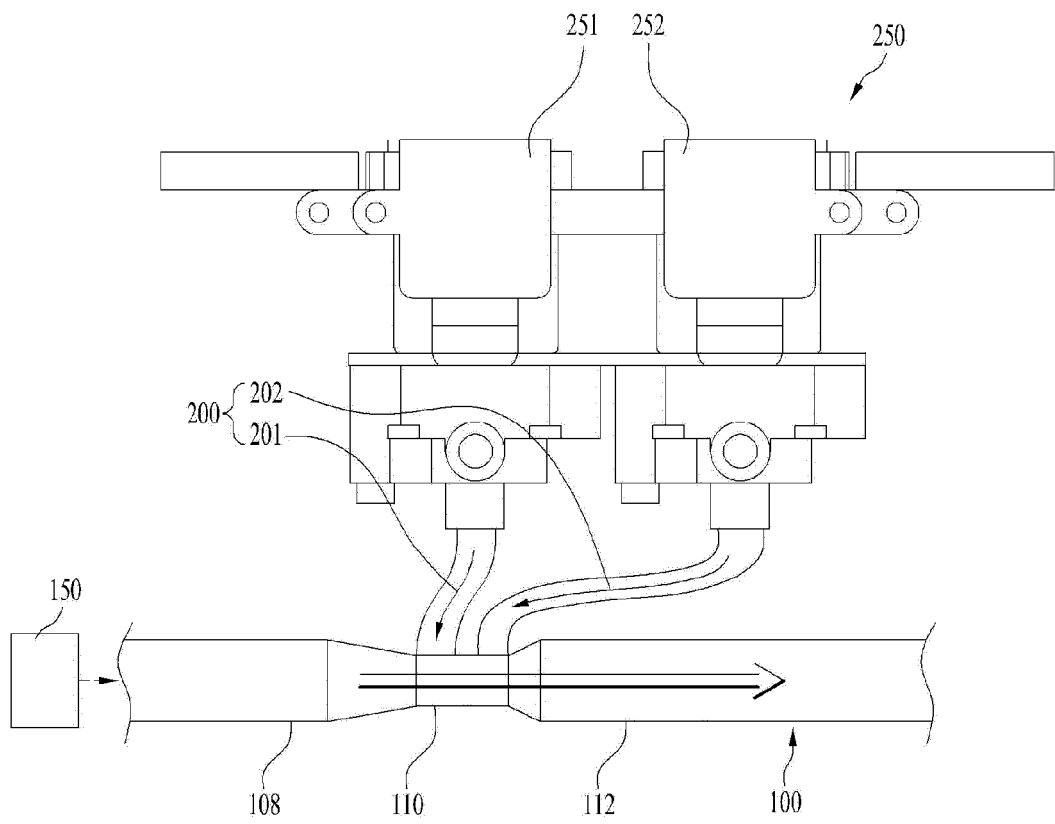
【FIG. 3】



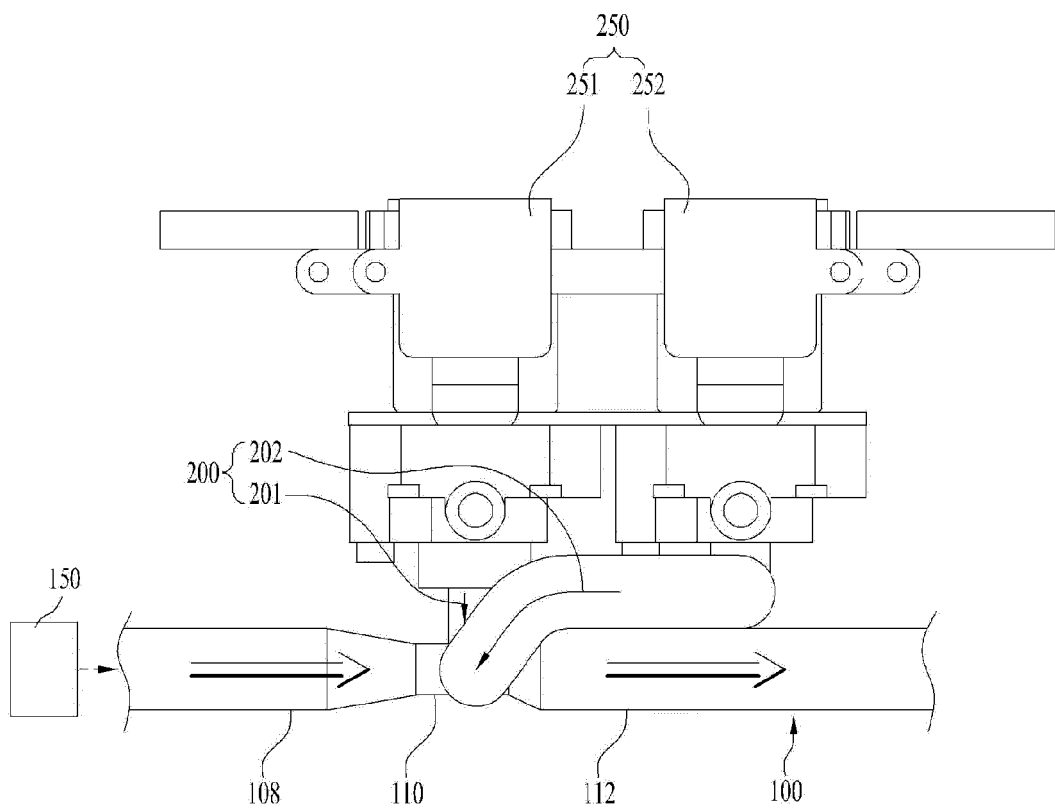
【FIG. 4】



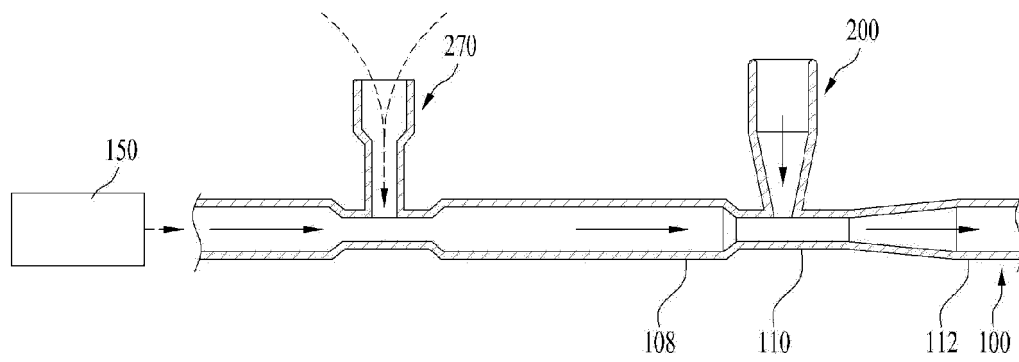
【FIG. 5】



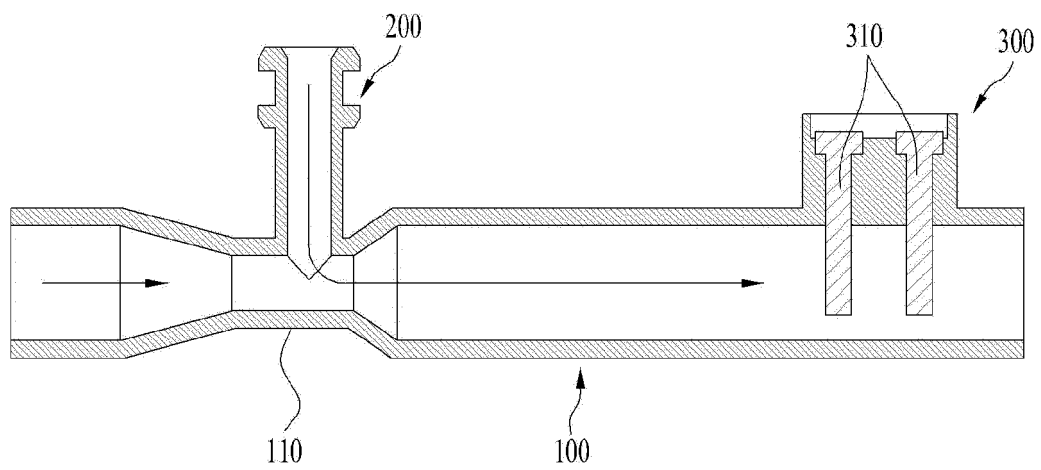
【FIG. 6】



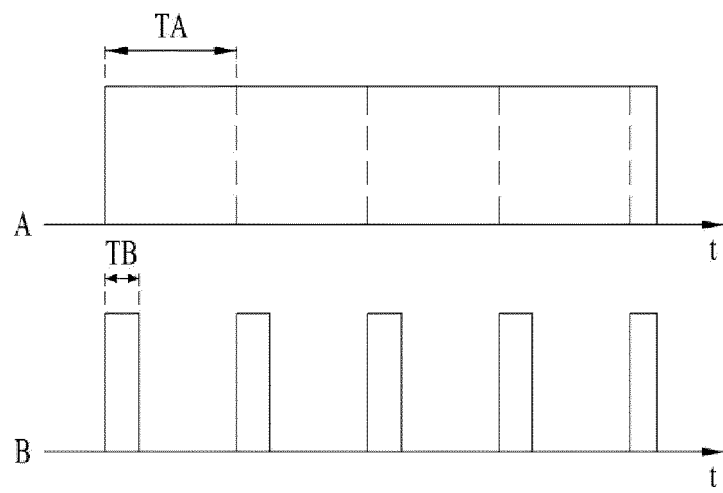
【FIG. 7】



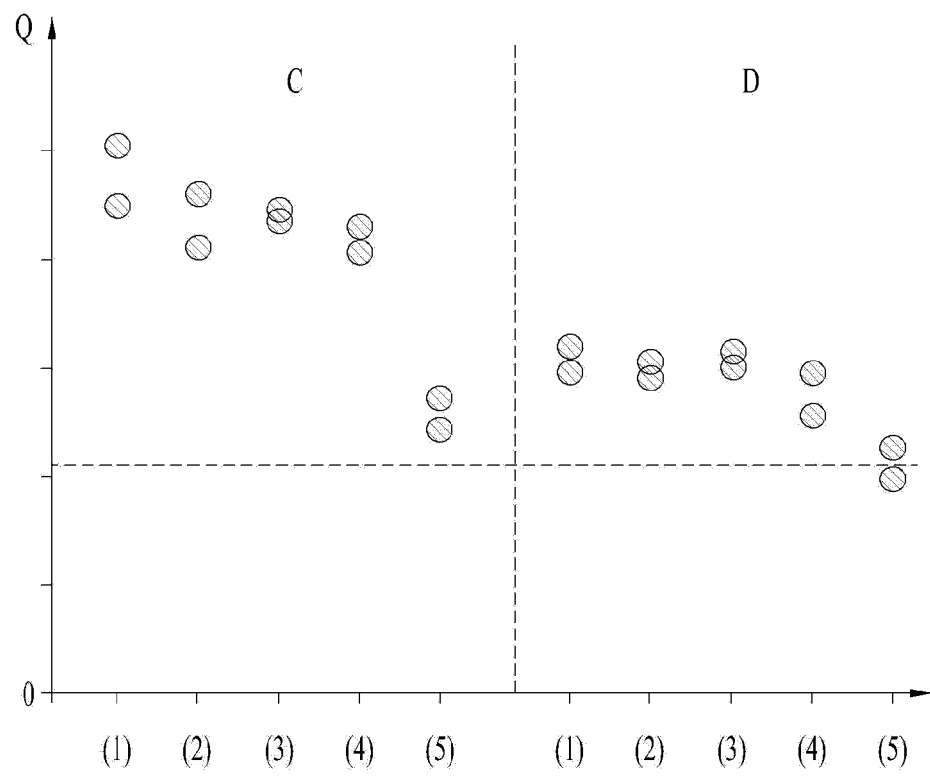
【FIG. 8】



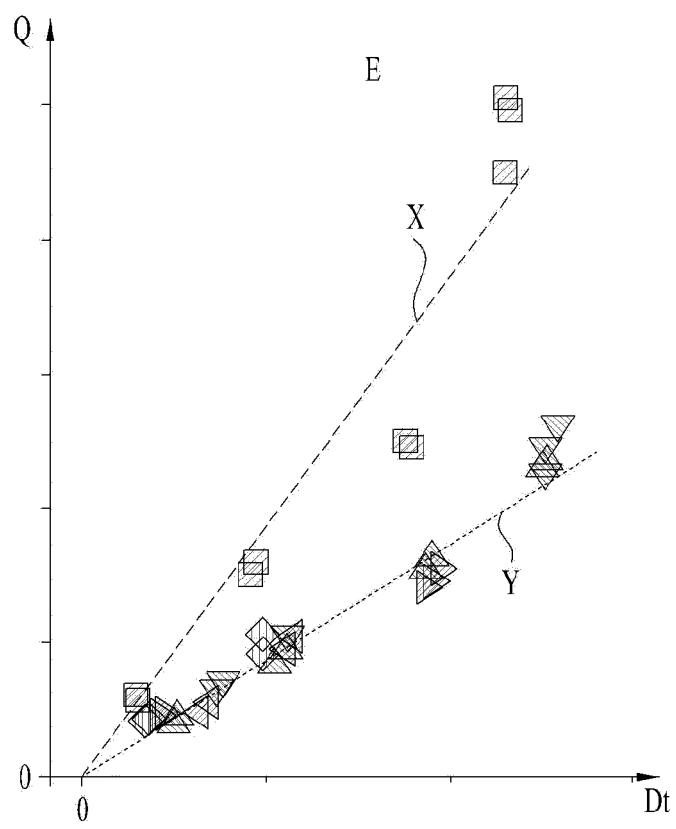
【FIG. 9】



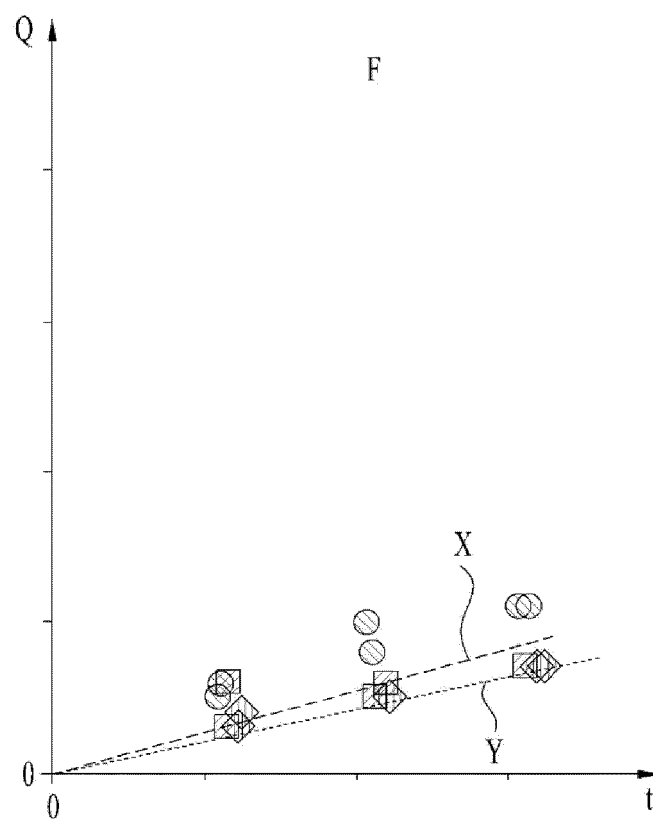
【FIG. 10】



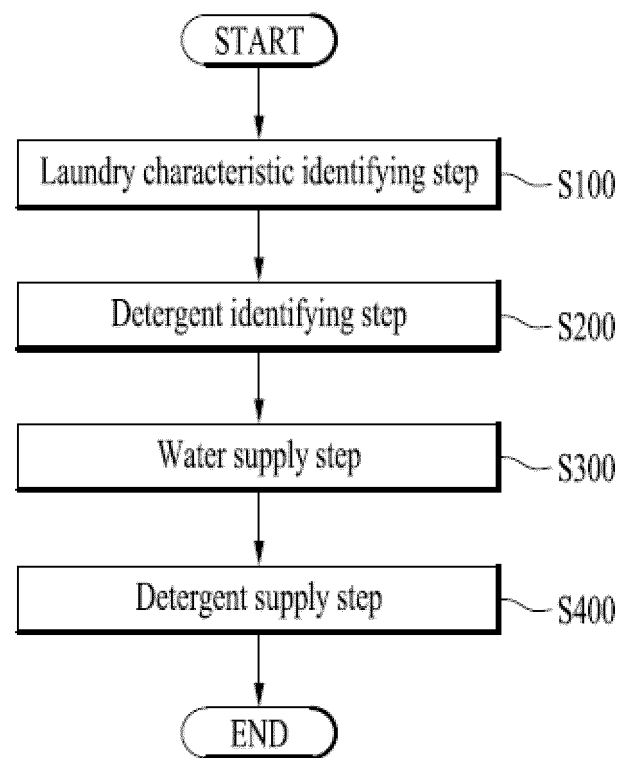
【FIG. 11】



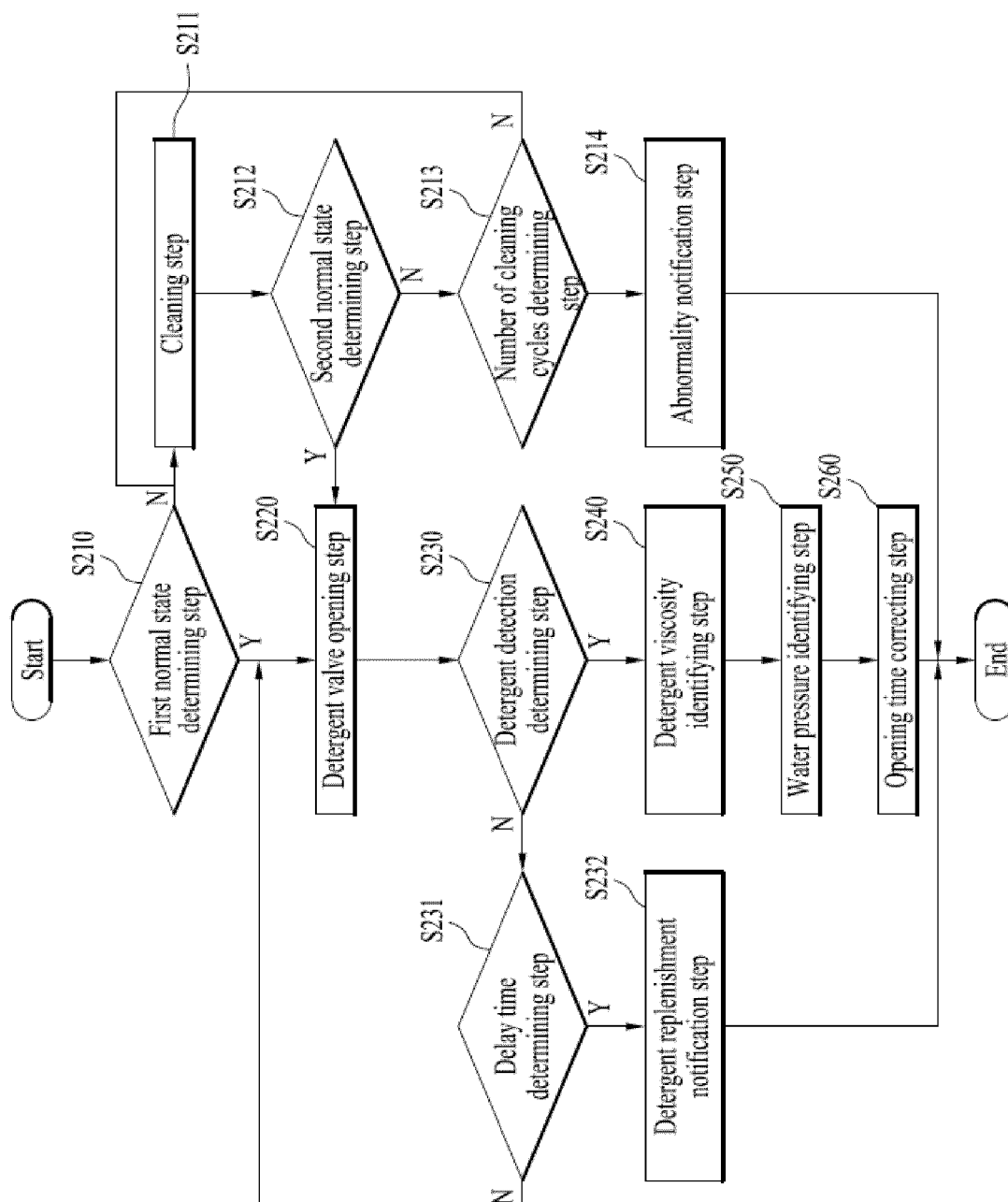
【FIG. 12】



【FIG. 13】



【FIG. 14】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2023/000294

A. CLASSIFICATION OF SUBJECT MATTER

D06F 39/02(2006.01)i; D06F 34/14(2020.01)i; D06F 33/37(2020.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06F 39/02(2006.01); D06F 33/30(2020.01); D06F 33/37(2020.01); D06F 39/08(2006.01); F16K 1/00(2006.01);
F16K 1/38(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 의류처리장치(clothes treating apparatus), 급수관(water supply pipe), 세제저장부
(detergent storage part), 세제관(detergent pipe), 목부(throat)**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	CN 112663295 A (GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 16 April 2021 (2021-04-16) See paragraphs [0042] and [0044] and figures 1-2 and 6.	5,8-9
Y	KR 10-1233243 B1 (DAEWOO ELECTRONICS CORPORATION) 14 February 2013 (2013-02-14) See paragraphs [0034] and [0038]-[0039] and figure 3.	6-7
Y	KR 10-2020-0120200 A (LG ELECTRONICS INC.) 21 October 2020 (2020-10-21) See paragraphs [0211] and [0260]-[0263] and figure 17.	12-14

☒ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

13 April 2023

Date of mailing of the international search report

14 April 2023

Name and mailing address of the ISA/KR

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Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2023/000294

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/000294

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