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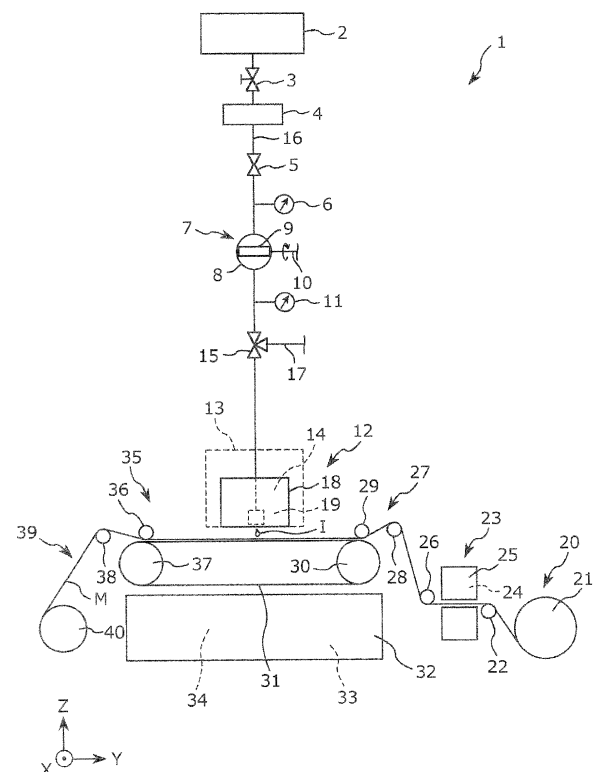
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(54) **LIQUID DISCHARGING APPARATUS AND METHOD FOR CLEANING FILTER**

(57) A liquid discharging apparatus includes a supply flow path through which ink as liquid is supplied to a discharging unit from an accommodation portion of the ink, a sheet-like filter arranged in the supply flow path, a posture changing unit capable of changing a posture of the filter such that the filter is inverted, a branch flow path provided between the filter and the discharging unit in the supply flow path, and a switching unit capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, wherein the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path.

FIG. 1



Description

BACKGROUND

1. Technical Field

[0001] The present invention relates to a liquid discharging apparatus and a method for cleaning a filter.

2. Related Art

[0002] Various existing liquid discharging apparatuses that discharge ink as liquid from a discharging unit have been used. Among the liquid discharging apparatuses, a liquid discharging apparatus that includes a filter in a supply path of ink from an accommodation portion of the ink to a discharging unit, and which aims at suppression of mixing of foreign matters into the discharging unit, has been used.

[0003] For example, JP-A-2006-95882 discloses a liquid discharging apparatus including a detachable filter in a flow path to a liquid discharging unit from a cartridge as an accommodation portion of ink.

[0004] JP-A-2012-799 discloses a liquid discharging apparatus including a filter a posture of which can be changed so as to be along a flow direction of ink in a supply path to nozzles of a recording head as a discharging unit from an ink cartridge as an accommodation portion of the ink.

[0005] However, in the existing liquid discharging apparatuses including the filter in the supply path of the ink, the filter is gradually clogged with foreign matters and an ink flow rate is therefore lowered due to clogging of the filter with the foreign matters in some cases. In the configuration including the detachable filter as disclosed in JP-A-2006-95882, the filter is frequently clogged with the foreign matters depending on an ink type that is used and needs to be replaced frequently. Replacement of the filter causes a large burden depending on the filter configuration, the apparatus configuration, and the like in some cases.

[0006] On the other hand, with the configuration including the filter the posture of which can be changed so as to be along the flow direction of the ink as disclosed in JP-A-2012-799, foreign matters being caught in the filter can be removed with a small burden by changing the posture of the filter so as to be along the flow direction of the ink and making liquid flow through the filter for a while when the filter becomes clogged with the foreign matters.

[0007] However, in recent years, it has been desired by users that foreign matters being caught in a filter can be removed more effectively.

SUMMARY

[0008] An advantage of some aspects of the invention is to effectively suppress, with a small burden, mixing of

foreign matters into a discharging unit with supply of ink from an accommodation portion of the ink to the discharging unit.

[0009] A liquid discharging apparatus according to a first aspect of the invention includes a supply flow path through which ink as liquid is supplied to a discharging unit from an accommodation portion of the ink, a sheet-like filter arranged in the supply flow path, a posture changing unit capable of changing a posture of the filter such that the filter is inverted, a branch flow path provided between the filter and the discharging unit in the supply flow path, and a switching unit capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, wherein the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path.

[0010] With this aspect, the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of inverting the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path. That is to say, foreign matters being caught in the filter can be easily removed without replacing the filter by inverting the filter. The foreign matters being caught in the filter can be effectively removed by turning the filter in a direction opposite to a flow direction of the liquid. Furthermore, the foreign matters can be prevented from entering the discharging unit by making the liquid which has passed through the formation position of the filter flow to the branch flow path, thereby suppressing mixing of the foreign matters into the discharging unit.

[0011] A liquid discharging apparatus according to a second aspect of the invention includes a supply flow path through which ink as liquid is supplied to a discharging unit from an accommodation portion of the ink, a sheet-like filter arranged in the supply flow path, a posture changing unit capable of changing a posture of the filter, a determination unit determining a flowing degree of the liquid flowing in the supply flow path, a branch flow path provided between the filter and the discharging unit in the supply flow path, and a switching unit capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, wherein when the determination unit determines that the flowing degree does not satisfy a predetermined flowing degree, the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the liquid which has passed through the formation position

of the filter is capable of being made to flow to the branch flow path.

[0012] With this aspect, when the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree, the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path. That is to say, foreign matters being caught in the filter can be easily removed without replacing the filter by changing the posture of the filter. Determination, by the determination unit, that the flowing degree does not satisfy the predetermined flowing degree enables the foreign matters being caught in the filter to be effectively removed at an appropriate timing. Furthermore, the foreign matters can be prevented from entering the discharging unit by making the liquid which has passed through the formation position of the filter flow to the branch flow path, thereby suppressing mixing of the foreign matters into the discharging unit.

[0013] Preferably, in the liquid discharging apparatus, the posture changing unit is capable of inverting the filter, and when the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree, the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of inverting the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path.

[0014] With this aspect, the posture changing unit is capable of inverting the filter, and when the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree, the posture changing unit inverts the filter. That is to say, the foreign matters being caught in the filter can be easily removed without replacing the filter by inverting the filter. The foreign matters being caught in the filter can be effectively removed by turning the filter in a direction opposite to a flow direction of the liquid.

[0015] Preferably, in the liquid discharging apparatus, a pressure detector is provided in the supply flow path, and the determination unit determines the flowing degree of the liquid which flows while passing through the formation position of the filter based on a detection result by the pressure detector.

[0016] With this aspect, the pressure detector is provided in the supply flow path, and the determination unit determines the flowing degree of the liquid which flows while passing through the formation position of the filter based on the detection result by the pressure detector. Therefore, the foreign matters being caught in the filter can be removed at an appropriate timing based on the detection result by the pressure detector.

[0017] Preferably, in the liquid discharging apparatus, two pressure detectors are provided in the supply flow path with the filter interposed between the pressure detectors, and the determination unit determines the flowing degree of the liquid which flows while passing through the formation position of the filter based on a difference between pressures detected by the two pressure detectors.

[0018] With this aspect, the determination unit determines the flowing degree of the liquid which flows while passing through the formation position of the filter based on the difference between the pressures detected by the two pressure detectors provided with the filter interposed therebetween. Therefore, an appropriate cleaning timing of the filter (posture changing timing of the filter) can be determined with high accuracy.

[0019] Preferably, in the liquid discharging apparatus, when the determination unit determines that the flowing degree currently satisfies the predetermined flowing degree after determining that the flowing degree does not satisfy the predetermined flowing degree, the posture changing unit returns the posture of the filter and the switching unit switches the flowing liquid which has passed through the formation position of the filter to flow to the discharging unit.

[0020] With this aspect, the determination unit determines that the flowing degree currently satisfies the predetermined flowing degree. Therefore, it can be determined that cleaning of the filter (change of the posture of the filter to make the liquid flow) has been appropriately executed. In addition, mixing of the foreign matters into the discharging unit can be effectively suppressed thereafter by returning the posture of the filter.

[0021] Preferably, in the liquid discharging apparatus, when the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree, the flowing liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path for a predetermined period of time.

[0022] With this aspect, when the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree, the flowing liquid which has passed through the formation position of the filter is made to flow to the branch flow path for the predetermined period of time. Therefore, the cleaning of the filter (change of the posture of the filter to make the liquid flow) can be easily controlled.

[0023] Preferably, in the liquid discharging apparatus, the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree based on lapse of a predetermined period of time after change of the posture of the filter.

[0024] With this aspect, the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree based on the lapse of the predetermined period of time from the change of the posture of the filter. Therefore, start of the cleaning of the filter

(change of the posture of the filter to make the liquid flow) can be easily controlled.

[0025] Preferably, in the liquid discharging apparatus, a calculation unit calculating an amount of the ink flowing in the supply flow path is provided, and the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree based on a calculation result by the calculation unit, which indicates passage of a predetermined amount of the ink through the formation position of the filter after change of the posture of the filter.

[0026] With this aspect, the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree based on the calculation result by the calculation unit, which indicates the passage of the predetermined amount of the ink through the formation position of the filter after the change of the posture of the filter. Therefore, a start of the cleaning of the filter (change of the posture of the filter to make the liquid flow) can be easily controlled.

[0027] Preferably, in the liquid discharging apparatus, the switching unit is capable of switching the ink to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the ink is capable of being made to flow to the branch flow path.

[0028] With this aspect, the filter is cleaned with the ink. Therefore, mixing of the foreign matters into the discharging unit can be suppressed with a simple configuration.

[0029] Preferably, in the liquid discharging apparatus, a cleaning liquid supply unit capable of supplying cleaning liquid as the liquid to the supply flow path while switching the liquid from the ink is provided between the accommodation portion and the filter in the supply flow path, the switching unit is capable of switching the cleaning liquid to pass through the formation position of the filter and flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the cleaning liquid is capable of being made to flow to the branch flow path.

[0030] With this aspect, the filter is cleaned with the cleaning liquid. Therefore, mixing of the foreign matters into the discharging unit can be effectively suppressed.

[0031] A method for cleaning a filter according to a third aspect of the invention in a liquid discharging apparatus that includes a supply flow path through which ink as liquid is supplied to a discharging unit from an accommodation portion of the ink, the sheet-like filter arranged in the supply flow path, a posture changing unit capable of inverting the filter, a branch flow path provided between the filter and the discharging unit in the supply flow path, and a switching unit capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, includes switching, by the switching unit, the liquid which has passed through the formation position of the filter to flow to the branch flow path, and inverting, by the posture changing unit, the filter, and making the liquid which has passed through the formation

position of the filter flow to the branch flow path.

[0032] With this aspect, the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of inverting the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path. That is to say, foreign matters being caught in the filter can be easily removed without replacing the filter by inverting the filter. The foreign matters being caught in the filter can be effectively removed by turning the filter in a direction opposite to a flow direction of the liquid. Furthermore, the foreign matters can be prevented from entering the discharging unit by making the liquid which has passed through the formation position of the filter flow to the branch flow path, thereby suppressing mixing of the foreign matters into the discharging unit.

[0033] A method for cleaning a filter according to a fourth aspect of the invention, in a liquid discharging apparatus that includes a supply flow path through which ink as liquid is supplied to a discharging unit from an accommodation portion of the ink, the sheet-like filter arranged in the supply flow path, a posture changing unit capable of changing a posture of the filter, a branch flow path provided between the filter and the discharging unit in the supply flow path, and a switching unit capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, includes determining a flowing degree of the liquid flowing in the supply flow path, and when it is determined that the flowing degree does not satisfy a predetermined flowing degree, switching, by the switching unit, the liquid which has passed through the formation position of the filter to flow to the branch flow path, changing, by the posture changing unit, the posture of the filter, and making the liquid which has passed through the formation position of the filter flow to the branch flow path.

[0034] With this aspect, when it is determined that the flowing degree does not satisfy the predetermined flowing degree, the switching unit is capable of switching the liquid which has passed through the formation position of the filter to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the liquid which has passed through the formation position of the filter is capable of being made to flow to the branch flow path. That is to say, foreign matters being caught in the filter can be easily removed without replacing the filter by changing the posture of the filter. Determination that the flowing degree does not satisfy the predetermined flowing degree enables the foreign matters being caught in the filter to be effectively removed at an appropriate timing. Furthermore, the foreign matters can be prevented from entering the discharging unit by making the liquid which has passed through the formation position of the filter flow to the branch flow path, thereby suppressing mixing of the foreign matters into

the discharging unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] Embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings, wherein like numbers reference like elements.

Fig. 1 is a schematic view illustrating a printing apparatus according to a first embodiment of the invention.

Fig. 2 is a block diagram illustrating the printing apparatus in the first embodiment of the invention.

Fig. 3 is a schematic view illustrating a main part of the printing apparatus for explaining a method for cleaning a filter using the printing apparatus in the first embodiment of the invention.

Fig. 4 is a schematic view illustrating the main part of the printing apparatus for explaining the method for cleaning the filter using the printing apparatus in the first embodiment of the invention.

Fig. 5 is a schematic view illustrating the main part of the printing apparatus for explaining the method for cleaning the filter using the printing apparatus in the first embodiment of the invention.

Fig. 6 is a schematic view illustrating the main part of the printing apparatus for explaining the method for cleaning the filter using the printing apparatus in the first embodiment of the invention.

Fig. 7 is a flowchart of the method for cleaning the filter using the printing apparatus in the first embodiment of the invention.

Fig. 8 is a schematic view illustrating a printing apparatus according to a second embodiment of the invention.

Fig. 9 is a schematic view illustrating a main part of the printing apparatus for explaining a method for cleaning a filter using the printing apparatus in the second embodiment of the invention.

Fig. 10 is a schematic view illustrating the main part of the printing apparatus for explaining the method for cleaning the filter using the printing apparatus in the second embodiment of the invention.

Fig. 11 is a schematic view illustrating the main part of the printing apparatus for explaining the method for cleaning the filter using the printing apparatus in the second embodiment of the invention.

Fig. 12 is a schematic view illustrating the main part of the printing apparatus for explaining the method for cleaning the filter using the printing apparatus in the second embodiment of the invention.

Fig. 13 is a flowchart of the method for cleaning the filter using the printing apparatus in the second embodiment of the invention.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0036] Hereinafter, a printing apparatus as a liquid discharging apparatus according to an embodiment of the invention will be described in detail with reference to the accompanying drawings.

First Embodiment (Fig. 1 to Fig. 7)

[0037] First, outline of a printing apparatus 1 according to a first embodiment of the invention is described.

[0038] Fig. 1 is a schematic view illustrating the printing apparatus 1 in the embodiment. Fig. 2 is a block diagram of the printing apparatus illustrated in Fig. 1.

[0039] Fig. 1 illustrates an X axis, a Y axis, and a Z axis as three axes orthogonal to one another for the convenience of explanation. The X axis is an axis along one direction of the horizontal direction and is an axis along the width of the printing apparatus, that is, a depth direction in the drawing. The Y axis is an axis along a direction perpendicular to the X axis as the horizontal direction, that is, along the lengthwise direction of the printing apparatus. The Z axis is an axis along the vertical direction, that is, along an up-down direction. A tip side of each arrow illustrated in the drawing is assumed to be a "positive side" or a "+" side" and a base end side thereof is assumed to be a "negative side" or a "-" side". The upper side in Fig. 1 is referred to as an "upper (upward) side" and the lower side in Fig. 1 is referred to as a "lower (downward) side".

[0040] In the specification, flow of ink I as liquid to the downstream side (discharging unit 12 side) from the upstream side (accommodation portion 2 side) is expressed as "ink I is supplied". Furthermore, the direction in which the ink I is supplied is not necessarily required to be identical to a gravity force direction.

[0041] The printing apparatus 1 illustrated in Fig. 1 includes the accommodation portion 2, the discharging unit 12, and a supply flow path 16. The accommodation portion 2 accommodates therein the ink I. The discharging unit 12 receives the ink I supplied from the accommodation portion 2 and discharges the supplied ink I for printing. The supply flow path 16 connects the accommodation portion 2 and the discharging unit 12 and the ink I flows toward the discharging unit 12 from the accommodation portion 2 in the supply flow path 16.

[0042] A sub accommodation portion 4 that temporarily stores therein the ink I flowing toward the discharging unit 12 side from the accommodation portion 2 is provided in the supply flow path 16 and a solenoid valve 3 is provided between the accommodation portion 2 and the sub accommodation portion 4. The solenoid valve 3 opens and closes the supply flow path 16 between the accommodation portion 2 and the sub accommodation portion 4 and switches whether the ink I is supplied to the sub accommodation portion 4 from the accommodation portion 2. As illustrated in Fig. 2, the solenoid valve 3 is electrically connected to a controller 33 and an operation

thereof is controlled.

[0043] Furthermore, a valve 5 and a valve 15 that are electrically connected to the controller 33 are provided in the supply flow path 16. A foreign matter removal unit 7 having a sheet-like filter 9 capturing foreign matters of the ink I is provided between the valve 5 and the valve 15. The foreign matter removal unit 7 includes the filter 9, a filter chamber 8, and a rotation unit 10. The filter 9 is formed in the filter chamber 8. The rotation unit 10 is electrically connected to the controller 33 and can rotate (invert) the filter 9. Furthermore, the valve 15 is configured to be capable of switching whether or not to make the liquid (ink I) which has flowed toward the valve 15 from the upstream side (accommodation portion 2 side) flow to the discharging unit 12 or to a branch flow path 17 toward a waste tank (not illustrated). A position of the filter chamber 8 (a formation position of the filter 9) is desirably located in the vicinity of the discharging unit 12 so as to be closer to the discharging unit 12 relative to a center portion of the supply flow path 16 between the accommodation portion 2 and the discharging unit 12, for example. This location enables the foreign matters to be removed at a position close to a position just before the discharging unit 12.

[0044] The "sheet-like" filter indicates a filter having a thin plate shape but is not limited thereto and includes a flexible filter, a wave-like filter, and the like.

[0045] Examples of the "filter" include a filter that is configured by a sheet material formed by, for example, weaving a metal wire material to have a large number of fine pores, and exerts its function by transmitting the ink through the fine pores and suppressing transmission of the foreign matters. The filter is however not limited to be configured in this manner. For example, the filter may be configured by a material other than the metal material as long as it has resistance to the ink I.

[0046] Furthermore, a pressure sensor 6 and a pressure sensor 11 as pressure detectors capable of detecting pressures of the supply flow path 16 are respectively provided at the upstream side and the downstream side of the foreign matter removal unit 7 in the supply flow path 16.

[0047] It should be noted that the printing apparatus 1 in the embodiment is configured to be capable of cleaning the filter 9 under the control of the controller 33. Detailed operations (a method for cleaning the filter 9) related to the valve 15, the foreign matter removal unit 7, the pressure sensor 6, and the pressure sensor 11 when the filter 9 is cleaned will be described later.

[0048] Hereinafter, the respective parts of the printing apparatus 1 will be described in detail.

[0049] As illustrated in Fig. 1, the printing apparatus 1 includes an apparatus base 32, the accommodation portion 2, the discharging unit 12, the supply flow path 16, a transportation unit 27, a drying unit 23, an elevation mechanism 14, and the controller 33. The discharging unit 12 discharges the ink I supplied from the accommodation portion 2 onto a medium M for printing. The supply

flow path 16 connects the accommodation portion 2 and the discharging unit 12. The transportation unit 27 transports the medium M. The drying unit 23 dries the ink I on the medium M.

[0050] In the embodiment, a direction orthogonal to the transportation direction in which the medium M is transported is the X-axis direction, a direction in parallel with the transportation direction is the Y-axis direction, and a direction orthogonal to the X-axis direction and the Y-axis direction is the Z-axis direction.

[0051] The accommodation portion 2 accommodates therein the ink I for respective colors independently. As the ink I, inks of four colors of, for example, cyan, magenta, yellow, and black, which contain dyes or pigments as colorants in water as a solvent, can be used. The accommodation portion 2 that is used can also be changed (that is, to an accommodation portion accommodating therein different types of inks) and in this case, the filter 9 and the supply flow path 16 need to be cleaned.

[0052] The transportation unit 27 includes a feeding device 39, a winding device 20, and a support device 35. The feeding device 39 feeds out the long medium M wound into a roll form. The winding device 20 winds up the medium M on which printing has been performed.

The support device 35 supports the medium M in printing.

[0053] The feeding device 39 is arranged at the upstream side in the feeding direction of the medium M, that is, at the upstream side in the Y-axis direction relative to the apparatus base 32. The feeding device 39 has a feeding roller 40 and a tensioner 38. The medium M is wound around the feeding roller 40 in the roll form and the feeding roller 40 feeds out the medium M. The tensioner 38 applies tension to the medium M between the feeding roller 40 and the support device 35. A motor (not illustrated) is connected to the feeding roller 40 and the feeding roller 40 can be rotated with operation of the motor.

[0054] A printing target material can be used as the medium M. The printing target material is any of fabrics, clothes, other garments, and the like on which printing is to be performed. The fabrics include woven fabrics, knitted fabrics, non-woven fabrics, and the like of natural fibers such as cotton, silk, and wool, chemical fibers such as nylon, and composite fibers obtained by mixing them. Furthermore, the clothes and the other garments include T-shirts, handkerchiefs, scarfs, towels, carrier bags, fabric bags, furniture products such as curtains, sheets, bed covers or the like after sewing, fabrics before and after cutting as parts in states before sewing, and the like.

[0055] When the printing target material is used as the medium M, concentrations of the colorants contained in the ink I that is used tend to be increased. Therefore, the colorants are crystallized and the crystals of the colorants tend to be caught as the foreign matters in the filter 9.

[0056] Furthermore, as the medium M, in addition to the above-described printing target materials, exclusive paper for ink jet recording, such as plain paper, high-quality paper, and glossy paper, or the like can be used.

Moreover, as the medium M, for example, a plastic film on which surface processing for ink jet printing is not performed, that is, an ink absorbing layer is not formed, a medium formed by coating a base material such as paper with plastic, a medium formed by making a plastic film adhere to the base material, or the like can also be used. The plastic is not particularly limited but examples thereof include polyvinyl chloride, polyethylene terephthalate, polycarbonate, polystyrene, polyurethane, polyethylene, and polypropylene.

[0057] The winding device 20 is arranged at the downstream side in the feeding direction of the medium M, that is, at the downstream side in the Y-axis direction relative to the feeding device 39 with respect to the apparatus base 32. The winding device 20 has a winding roller 21, a tensioner 22, a tensioner 26, and a tensioner 28. The winding roller 21 winds up the medium M into a roll form. The tensioner 22, the tensioner 26, and the tensioner 28 apply tension to the medium M between the winding roller 21 and the support device 35. A motor (not illustrated) is connected to the winding roller 21 and the winding roller 21 can be rotated with an operation of the motor. The tensioner 22, the tensioner 26, and the tensioner 28 are arranged in this order in the direction of being farther from the winding roller 21 with spaces therebetween.

[0058] The support device 35 is arranged between the feeding device 39 and the winding device 20. The support device 35 has a driving roller 37 and a driven roller 30, an endless belt 31, and a tensioner 36 and a tensioner 29. The driving roller 37 and the driven roller 30 are arranged so as to be separated from each other in the Y-axis direction. The endless belt 31 is wound around the driving roller 37 and the driven roller 30 and supports the medium M on the upper surface thereof. The tensioner 36 and the tensioner 29 apply tension to the medium M between the driving roller 37 and the driven roller 30.

[0059] A motor (not illustrated) is connected to the driving roller 37 and the driving roller 37 can be rotated with an operation of the motor. A rotation force of the driving roller 37 is transmitted to the driven roller 30 through the endless belt 31, so that the driven roller 30 can be rotated while interlocking with the driving roller 37.

[0060] The endless belt 31 is a belt on which an adhesive layer having adhesiveness is formed on the surface thereof at the front side. A part of the medium M is made to adhesively fix to the adhesive layer, so that the medium M is transported in the Y-axis direction. Printing is performed on the medium M during the transportation. After printing is performed, the medium M is separated from the endless belt 31.

[0061] The tensioner 36 and the tensioner 29 are also arranged so as to be separated from each other in the Y-axis direction similarly to the driving roller 37 and the driven roller 30.

[0062] The tensioner 36 and the driving roller 37 can nip both the medium M and the endless belt 31 therebetween and the tensioner 29 and the driven roller 30 can

nip both the medium M and the endless belt 31 therebetween. The medium M to which the tensioner 36 and the tensioner 29 apply tension is thereby fixed to the endless belt 31 and transported while keeping the state in which the tension is applied thereto. This state reduces, for example, wrinkling or the like of the medium M during the transportation. Therefore, printing is performed reliably with high quality when printing is performed on the medium M.

[0063] As illustrated in Fig. 2, the transportation unit 27 is electrically connected to the controller 33 and an operation thereof is controlled.

[0064] The discharging unit 12 includes a carriage unit 18 and an X-axis table (not illustrated). The carriage unit 18 has a plurality of nozzles 19 through which the ink I is discharged onto the medium M for recording by printing. The X-axis table supports the carriage unit 18 such that the carriage unit 18 is movable in the X-axis direction. The printing apparatus 1 has a movable portion 13 and the movable portion 13 including the discharging unit 12 is a portion that can be moved in printing.

[0065] The discharging unit 12 has piezoelectric elements that respectively correspond to the nozzles 19 and the ink I is discharged as liquid droplets through the respective nozzles 19 when voltage is applied to the piezoelectric elements. The discharging unit 12 is electrically connected to the controller 33 and an operation thereof is controlled.

[0066] In the printing apparatus 1, the medium M fed out by the feeding device 39 is intermittently transported as sub scanning in the Y-axis direction in a fixed state in which the medium M is made to adhere to and is fixed to the endless belt 31 and the ink I is discharged onto the medium M in the fixed state while making the carriage unit 18 reciprocate as main scanning in the X-axis direction. This operation can be performed until printing is completed and an image pattern is formed on the medium M. It should be noted that the image pattern may be formed by multicolor printing or monochrome printing.

[0067] The elevation mechanism 14 illustrated in Fig. 1 can adjust the height of the nozzles 19. The elevation mechanism 14 can be configured including a motor, a ball screw, and a linear guide, for example. An encoder is incorporated in the motor. The height of the nozzles 19 can be detected based on a rotation amount detected by the encoder. As illustrated in Fig. 2, the transportation unit 14 is also electrically connected to the controller 33 and an operation thereof is controlled.

[0068] As illustrated in Fig. 1, the drying unit 23 is arranged between the support device 35 and the winding roller 21 of the winding device 20 at the downstream side relative to the discharging unit 12 in the transportation direction of the medium M.

[0069] The drying unit 23 has a chamber 25 and a coil 24 arranged in the chamber 25. The coil 24 is configured by, for example, a nichrome wire and is a heat generator generating heat by supplying electric power thereto. The ink I on the medium M passing through the chamber 25

can be dried with heat generated by the coil 24.

[0070] As illustrated in Fig. 2, the controller 33 includes a central processing unit (CPU) 41 and a storage unit 42.

[0071] The CPU 41 executes programs for various pieces of processing such as the above-described printing processing.

[0072] The storage unit 42 has, for example, an Electrically Erasable Programmable Read-Only Memory (EEPROM) as one type of non-volatile semiconductor memories, or the like, and can store therein various programs and the like.

[0073] A notification unit 34 notifies a user of the occurrence of clogging (in which a predetermined flowing degree is not satisfied) in the filter 9, execution of a cleaning operation of the filter 9, and the like as will be described later. The notification unit 34 is configured by, for example, a monitor, a buzzer, a lamp, or the like. The notification unit 34 can thereby notify the user of the execution of the cleaning operation of the filter 9 or can prompt the user to perform a replacement operation of the filter 9 depending on the case.

[0074] Next, a method for cleaning the filter 9 using the printing apparatus 1 in the embodiment will be described.

[0075] Fig. 3 to Fig. 6 are schematic views illustrating a main part of the printing apparatus 1 for explaining the method for cleaning the filter 9 using the printing apparatus 1 in the embodiment and illustrate states in predetermined processes in the cleaning method of the filter 9.

[0076] Fig. 7 is a flowchart of the method for cleaning the filter 9 using the printing apparatus 1 in the embodiment.

[0077] As illustrated in Fig. 7, when processing of the method for cleaning the filter 9 using the printing apparatus 1 in the embodiment is started, first, printing is started at step S110. To be specific, printing is started upon input of print data from a PC (personal computer) (not illustrated) or the like connected to the printing apparatus 1 in the embodiment.

[0078] Then, at step S120, a pressure P1 at the upstream side of the filter 9 and a pressure P2 at the downstream side thereof are detected. To be specific, the pressure sensor 6 detects the pressure P1 at the upstream side of the filter 9 and the pressure sensor 11 detects the pressure P2 at the downstream side of the filter 9. Then, the controller 33 determines whether or not a pressure difference ΔP between the pressure P1 and the pressure P2 is lower than a predetermined threshold value P0 at step S130.

[0079] It should be noted that Fig. 3 illustrates a state at steps S110 to S130.

[0080] As illustrated in Fig. 3, the ink I flows in a direction A1 at the upstream side of the filter 9 in the supply flow path 16, flows in a direction A2 between the filter 9 and the valve 15 in the supply flow path 16, and flows in a direction A3 at the downstream side of the valve 15 in the supply flow path 16.

[0081] Then, when $\Delta P \geq P0$ is determined to be satisfied at step S130, it is regarded that the filter 9 is clogged

and a switching operation of the valve 15 is performed at step S140. That is to say, as illustrated in Fig. 4, the ink I is switched to flow in a direction A3' from the direction A3 by operating the valve 15 to switch the direction in which the ink I flows.

[0082] Thereafter, at step S150, the rotation unit 10 is driven under the control of the controller 33, so that the filter 9 is inverted by being rotated in a rotation direction B as illustrated in Fig. 5. That is to say, in the printing apparatus 1 in the embodiment, the filter 9 is set such that a front surface 9a is located at the upstream side in the flow direction of the ink I in a normal state such as at the time of printing and the like. On the other hand, the filter 9 is rotated such that a rear surface 9b is located at the upstream side in the flow direction of the ink I at the time of cleaning of the filter 9.

[0083] In the embodiment, when the valve 15 is switched (step S140) and the filter 9 is rotated (step S150), the valve 5 is closed to stop flow of the ink I. It should be noted that when the valve 15 is switched and the filter 9 is rotated, the flow of the ink I may not be stopped.

[0084] Subsequently, at step S160, the filter 9 is cleaned with the ink I by making the ink I flow to the branch flow path 17 from the upstream side of the filter 9 while passing through the downstream side of the filter 9 (that is to say, supplying the ink I as the liquid to the filter chamber 8 and making the ink I pass therethrough). The printing apparatus 1 in the embodiment is configured to clean the filter 9 with the ink I in this manner.

[0085] Then, at step S170, in order to let the user know of the occurrence of clogging of the filter 9 and execution of cleaning of the filter 9, the same is notified to the user by being displayed on a monitor (not illustrated) or the like and so on. It should be noted that this step can be omitted.

[0086] Subsequently, at step S180, the filter 9 is cleaned until a predetermined condition is satisfied. In the embodiment, the filter 9 is cleaned until the pressure difference ΔP between the pressure P1 and the pressure P2 is lower than a predetermined threshold value $P\alpha$.

[0087] When $\Delta P < P\alpha$ is satisfied at step S180, the filter 9 is inverted by being rotated in the rotation direction B as illustrated in Fig. 6 at step S190. That is to say, arrangement of the filter 9 is returned such that the front surface 9a is located at the upstream side in the flow direction of the ink I.

[0088] From the viewpoints that the filter 9 in the embodiment has the front surface 9a and the rear surface 9b which are distinguished from each other and flow of the foreign matters which have not been completely cleaned to the discharging unit 12 is suppressed by returning the arrangement of the filter 9, the arrangement of the filter 9 is returned such that the front surface 9a is located at the upstream side in the flow direction of the ink I at this step. When a filter having a front surface and a rear surface which are not distinguished from each other is used and so on, this step can be omitted.

[0089] Then, the switching operation of the valve 15 is performed at step S200. That is to say, the ink I is switched to flow in the direction A3 from the direction A3' by operating the valve 15 to switch the direction in which the ink I flows such that the state illustrated in Fig. 6 shifts to the state illustrated in Fig. 3. The method for cleaning the filter 9 in the embodiment is ended with completion of this step.

[0090] In the embodiment, when the filter 9 is returned (step S190) and the valve 15 is switched (step S200), the valve 5 is closed to stop the flow of the ink I. It should be noted that when the filter 9 is returned and the valve 15 is switched, the flow of the ink I may not be stopped.

[0091] As described above, the method for cleaning the filter in the embodiment is the method for cleaning the filter 9 in the printing apparatus 1 that includes the supply flow path 16 through which the ink I as liquid is supplied to the discharging unit 12 from the accommodation portion 2 of the ink I, the sheet-like filter 9 arranged in the supply flow path 16, the rotation unit 10 as a posture changing unit capable of inverting the filter 9, the branch flow path 17 provided between the filter 9 and the discharging unit 12 in the supply flow path 16, and the valve 15 as a switching unit capable of switching to make the flowing liquid (ink I) which has passed through the formation position of the filter 9 (filter chamber 8) flow whether to the discharging unit 12 or to the branch flow path 17.

[0092] The valve 15 switches the liquid which has passed through the formation position of the filter 9 to flow to the branch flow path 17 (step S140), the rotation unit 10 inverts the filter 9 (step S150), and the liquid which has passed through the formation position of the filter 9 is made to flow to the branch flow path 17 (step S160).

[0093] With the method for cleaning the filter 9 in the embodiment, the foreign matters being caught in the filter 9 can be easily removed without replacing the filter 9 by inverting the filter 9. The foreign matters being caught in the filter 9 can be effectively removed by turning (inverting) the filter 9 in a direction opposite to a flow direction of the liquid. Furthermore, the foreign matters can be prevented from entering the discharging unit 12 by making the liquid which has passed through the formation position of the filter 9 flow to the branch flow path 17, thereby suppressing mixing of the foreign matters into the discharging unit 12.

[0094] In other words, the printing apparatus 1 in the embodiment includes the supply flow path 16 through which the ink I as the liquid is supplied to the discharging unit 12 from the accommodation portion 2 of the ink I, the sheet-like filter 9 arranged in the supply flow path 16, the rotation unit 10 capable of changing the posture of the filter 9 such that the filter 9 is inverted, the branch flow path 17 provided between the filter 9 and the discharging unit 12 in the supply flow path 16, and the valve 15 capable of switching to make the flowing liquid (ink I) which has passed through the formation position of the filter 9 flow whether to the discharging unit 12 or to the branch flow path 17.

[0095] The printing apparatus 1 is configured such that the valve 15 is capable of switching the liquid which has passed through the formation position of the filter 9 to flow to the branch flow path 17, the rotation unit 10 is capable of changing the posture of the filter 9, and the liquid which has passed through the formation position of the filter 9 is capable of being made to flow to the branch flow path 17.

[0096] With the printing apparatus 1 in the embodiment, the foreign matters being caught in the filter 9 can be easily removed without replacing the filter 9 by inverting the filter 9. The foreign matters being caught in the filter 9 can be effectively removed by turning the filter 9 such that its front face 9a faces in the direction opposite to the flow direction of the liquid. Furthermore, the foreign matters can be prevented from entering the discharging unit 12 by making the liquid which has passed through the formation position of the filter 9 flow to the branch flow path 17, thereby suppressing mixing of the foreign matters into the discharging unit 12.

[0097] As is summarized from another viewpoint, the method for cleaning the filter in the embodiment is the method for cleaning the filter 9 in the printing apparatus 1 that includes the supply flow path 16 through which the ink I as the liquid is supplied to the discharging unit 12 from the accommodation portion 2 of the ink I, the sheet-like filter 9 arranged in the supply flow path 16, the rotation unit 10 capable of changing the posture of the filter 9, the branch flow path 17 provided between the filter 9 and the discharging unit 12 in the supply flow path 16, and the valve 15 capable of switching to make the flowing liquid (ink I) which has passed through the formation position of the filter 9 flow whether to the discharging unit 12 or to the branch flow path 17.

[0098] The flowing degree of the liquid flowing in the supply flow path 16 is determined (step S130), and when it is determined that the flowing degree does not satisfy the predetermined flowing degree, the valve 15 switches the liquid which has passed through the formation position of the filter 9 to flow to the branch flow path 17 (step S140), the rotation unit 10 changes the posture of the filter 9 (step S150), and the liquid which has passed through the formation position of the filter 9 is made to flow to the branch flow path 17 (step S160).

[0099] With the method for cleaning the filter 9 in the embodiment, the foreign matters being caught in the filter 9 can be easily removed without replacing the filter 9 by changing the posture of the filter 9. Determination that the flowing degree does not satisfy the predetermined flowing degree enables the foreign matters being caught in the filter 9 to be effectively removed at an appropriate timing. Furthermore, the foreign matters can be prevented from entering the discharging unit 12 by making the liquid which has passed through the formation position of the filter 9 flow to the branch flow path 17, thereby suppressing mixing of the foreign matters into the discharging unit 12.

[0100] In other words, the printing apparatus 1 in the

embodiment includes the supply flow path 16 through which the ink I as the liquid is supplied to the discharging unit 12 from the accommodation portion 2 of the ink I, the sheet-like filter 9 arranged in the supply flow path 16, the rotation unit 10 capable of changing the posture of the filter 9, the controller 33 as a determination unit determining the flowing degree of the liquid (ink I) flowing in the supply flow path 16, the branch flow path 17 provided between the filter 9 and the discharging unit 12 in the supply flow path 16, and the valve 15 capable of switching to make the flowing liquid which has passed through the formation position of the filter 9 flow whether to the discharging unit 12 or to the branch flow path 17.

[0101] The printing apparatus 1 is configured such that when the controller 33 determines that the flowing degree does not satisfy the predetermined flowing degree, the valve 15 is capable of switching the liquid which has passed through the formation position of the filter 9 to flow to the branch flow path 17, the rotation unit 10 is capable of changing the posture of the filter 9, and the liquid which has passed through the formation position of the filter 9 is capable of being made to flow to the branch flow path 17.

[0102] With the printing apparatus 1 in the embodiment, the foreign matters being caught in the filter 9 can be easily removed without replacing the filter 9 by changing the posture of the filter 9. Determination, by the controller 33, that the flowing degree does not satisfy the predetermined flowing degree enables the foreign matters being caught in the filter 9 to be effectively removed at an appropriate timing. Furthermore, the foreign matters can be prevented from entering the discharging unit 12 by making the liquid which has passed through the formation position of the filter 9 flow to the branch flow path 17, thereby suppressing mixing of the foreign matters into the discharging unit 12.

[0103] As described above, the printing apparatus 1 is configured such that the rotation unit 10 is capable of inverting the filter 9, and when the controller 33 determines that the flowing degree does not satisfy the predetermined flowing degree, the valve 15 is capable of switching the liquid which has passed through the formation position of the filter 9 to flow to the branch flow path 17, the rotation unit 10 is capable of inverting the filter 9, and the liquid which has passed through the formation position of the filter 9 is capable of being made to flow to the branch flow path 17. That is to say, the foreign matters being caught in the filter 9 can be easily removed without replacing the filter 9 by inverting the filter 9. The foreign matters being caught in the filter 9 can be effectively removed by turning the filter 9 such that its front surface 9a faces in the direction opposite to the flow direction of the liquid.

[0104] Furthermore, the printing apparatus 1 in the embodiment includes the pressure sensor 6 and the pressure sensor 11 as pressure detectors in the supply flow path 16 and the controller 33 can determine the flowing degree of the liquid which flows while passing through

the formation position of the filter 9 based on detection results by the pressure detectors. Therefore, the printing apparatus 1 in the embodiment has the configuration in which the foreign matters being caught in the filter 9 can be removed at an appropriate timing based on the detection results by the pressure detectors.

[0105] To be specific, the printing apparatus 1 in the embodiment includes the two pressure detectors (the pressure sensor 6 and the pressure sensor 11) with the filter interposed therebetween in the supply flow path 16 and the controller 33 determines the flowing degree of the liquid which flows while passing through the formation position of the filter 9 based on the pressure difference between the pressures detected by the two pressure detectors. Therefore, the printing apparatus 1 in the embodiment has the configuration in which an appropriate cleaning timing of the filter 9 (posture change timing of the filter 9) can be determined with high accuracy.

[0106] However, the configuration is not limited thereto. Alternatively, the flowing degree of the liquid which flows while passing through the formation position of the filter 9 may be determined by a method other than the pressure detectors or the flowing degree of the liquid which flows while passing through the formation position of the filter 9 may be determined based on a detection result by one pressure detector.

[0107] In the printing apparatus 1 in the embodiment, when the controller 33 determines that the flowing degree currently satisfies the predetermined flowing degree at step S180 after determining that the flowing degree does not satisfy the predetermined flowing degree at step S130, the rotation unit 10 returns the posture of the filter 9 at step S190 and the valve 15 switches the flowing liquid which has passed through the formation position of the filter 9 to flow to the discharging unit 12 at step S200. In this manner, the printing apparatus 1 in the embodiment can determine that cleaning of the filter 9 has been appropriately executed (the posture of the filter 9 has been changed to make the liquid flow) because it is determined that the flowing degree currently satisfies the predetermined flowing degree. In addition, the printing apparatus 1 in the embodiment can effectively suppress mixing of the foreign matters into the discharging unit 12 thereafter by returning the posture of the filter 9.

[0108] In the method for cleaning the filter in the embodiment as illustrated in Fig. 7, when the controller 33 determines that the flowing degree does not satisfy the predetermined flowing degree at step S130, the filter 9 is cleaned (liquid is supplied) continuously at step S160 until the controller 33 determines that the flowing degree satisfies the predetermined flowing degree at step S180.

[0109] Alternatively, the printing apparatus 1 in the embodiment can make the flowing liquid which has passed through the formation position of the filter 9 flow to the branch flow path 17 for the predetermined period of time when the controller 33 determines that the flowing degree does not satisfy the predetermined flowing degree at step S130. The printing apparatus 1 in the embodiment can

also easily control the cleaning of the filter 9 (change of the posture of the filter 9 to make the liquid flow) in this manner.

[0110] In the method for cleaning the filter in the embodiment as illustrated in Fig. 7, the controller 33 determines whether or not the flowing degree satisfies the predetermined flowing degree based on the detection results by the pressure sensor 6 and the pressure sensor 11 at step S130.

[0111] Alternatively, the controller 33 in the embodiment can also determine that the flowing degree does not satisfy the predetermined flowing degree based on lapse of a predetermined period of time (for example, one year) from the previous change of the posture of the filter 9 without using the detection results by the pressure sensor 6 and the pressure sensor 11. The printing apparatus 1 in the embodiment can also easily control the start of the cleaning of the filter 9 (change of the posture of the filter 9 to make the liquid flow) in this manner.

[0112] The controller 33 in the embodiment also serves as a calculation unit calculating an amount of the ink I flowing in the supply flow path 16 and can also determine that the flowing degree does not satisfy the predetermined flowing degree based on a calculation result which indicates passage of a predetermined amount of the ink I through the formation position of the filter 9 after change of the posture of the filter 9. The printing apparatus 1 in the embodiment can also easily control the start of the cleaning of the filter 9 (change of the posture of the filter 9 to make the liquid flow) in this manner.

[0113] It should be noted that the amount of the ink I flowing in the supply flow path 16 can be calculated based on pieces of stored information by, for example, storing, in the storage unit 42, the discharged amount of the ink I and the number of times of discharging with printing, and the consumed amount of the ink I with a maintenance operation (cleaning operation and the like) of the discharging unit 12 and the number of times of the maintenance operation.

[0114] As described above, the printing apparatus 1 in the embodiment is configured such that the valve 15 is capable of switching the ink I to flow to the branch flow path 17, the rotation unit 10 is capable of changing the posture of the filter 9, and the ink I is capable of being made to flow to the branch flow path 17. That is to say, the printing apparatus 1 in the embodiment suppresses mixing of the foreign matters into the discharging unit 12 with the simple configuration because the filter 9 is cleaned with the ink I.

[0115] It should be noted that the configuration is not limited thereto. The filter 9 may be capable of being cleaned with liquid which is different from the ink I.

Second Embodiment (Fig. 8 to Fig. 13)

[0116] Next, the printing apparatus 1 according to a second embodiment having the configuration in which the filter 9 can be cleaned with different liquid from the

ink I will be described.

[0117] Fig. 8 is a schematic view illustrating the printing apparatus 1 in the embodiment, and is a view corresponding to Fig. 1 illustrating the printing apparatus 1 in the first embodiment.

[0118] Fig. 9 to Fig. 12 are schematic views illustrating a main part of the printing apparatus 1 for explaining the method for cleaning the filter 9 using the printing apparatus 1 in the embodiment and correspond to Fig. 3 to Fig. 6 illustrating the printing apparatus 1 in the first embodiment.

[0119] Fig. 13 is a flowchart of the method for cleaning the filter 9 using the printing apparatus 1 in the embodiment and corresponds to Fig. 7 for the printing apparatus 1 in the first embodiment.

[0120] It should be noted that the same reference numerals denote common components to those in the above-described first embodiment and detailed description thereof is omitted. The electric configuration of the printing apparatus 1 in the embodiment is different from that of the printing apparatus 1 in the first embodiment only in a point that a valve 43 instead of the valve 5 is connected to the controller 33. Therefore, a view corresponding to Fig. 2 illustrating the printing apparatus 1 in the first embodiment is omitted.

[0121] As is obvious from comparison between Fig. 1 and Fig. 8, the printing apparatus 1 in the embodiment has substantially the same configuration as that of the printing apparatus 1 in the first embodiment other than a point that the valve 43 connected to a cleaning liquid supply unit 44 connected to a cleaning liquid accommodation portion 45 is formed instead of the valve 5. Therefore, the method for cleaning the filter 9 using the printing apparatus 1 in the embodiment will be mainly described.

[0122] Step S110 to step S130 in Fig. 13 are totally the same as step S110 to step S130 in Fig. 7 and detailed description thereof is therefore omitted.

[0123] It should be noted that Fig. 9 illustrates a state at steps S110 to S130.

[0124] As illustrated in Fig. 9, the ink I flows in the supply flow path 16 in a direction A0, a direction A1, a direction A2, and a direction A3 in this order.

[0125] In the method for cleaning the filter 9 in the embodiment, when $\Delta P \geq P0$ is determined to be satisfied at step S130, it is regarded that the filter 9 is clogged and switching operations of not only the valve 15 but also the valve 43 are performed at step S140. That is to say, as illustrated in Fig. 10, by operating the valve 43 and the valve 15 to switch the direction in which the liquid flows, the ink I is prevented from flowing to the downstream side of the valve 43 and the cleaning liquid is switched to flow in a direction A0', the direction A1, the direction A2, and a direction A3' in this order from the cleaning liquid accommodation portion 45.

[0126] Step S150 in Fig. 13 is totally the same as step S150 in Fig. 7 and detailed description thereof is therefore omitted. It should be noted that Fig. 11 illustrates a state corresponding to step S150 to step S180.

[0127] Also in the embodiment, when the valve 43 and the valve 15 are switched (step S140) and the filter 9 is rotated (step S150), flow of the liquids (the ink I and the cleaning liquid) is stopped. It should be noted that when the valve 43 and the valve 15 are switched and the filter 9 is rotated, the flow of the liquids may not be stopped.

[0128] At step S160, the filter 9 is cleaned with the cleaning liquid by making the cleaning liquid flow to the branch flow path 17 from the upstream side of the filter 9 while passing through the downstream side of the filter 9 (that is to say, supplying the cleaning liquid as the liquid to the filter chamber 8 and making the cleaning liquid pass therethrough). The printing apparatus 1 in the embodiment is configured to clean the filter 9 with the cleaning liquid in this manner.

[0129] Step S170 to step S190 in Fig. 13 are totally the same as step S170 to step S190 in Fig. 7 and detailed description thereof is therefore omitted.

[0130] The filter 9 is inverted by being rotated in a rotation direction B as illustrated in Fig. 12 at step S190.

[0131] Then, the switching operations of the valve 43 and the valve 15 are performed at step S200. That is to say, the cleaning liquid is prevented from flowing to the downstream side of the valve 43 and the ink I which has flowed in the direction A0, the direction A1, and the direction A2 in this order is switched to flow not in the direction A3' but in the direction A3 by operating the valve 43 and the valve 15 to switch the direction in which the ink I flows such that the state illustrated in Fig. 12 shifts to the state illustrated in Fig. 9.

[0132] In the embodiment, when the filter 9 is returned (step S190) and the valve 15 is switched (step S200), flow of the liquids (the ink I and the cleaning liquid) is stopped. It should be noted that when the filter 9 is returned and the valve 43 and the valve 15 are switched, the flow of the liquids may not be stopped.

[0133] Finally at step S210, the ink I is made to flow (the ink I is supplied to the supply flow path 16 and the filter chamber 8 and is made to pass therethrough) in the direction A0, the direction A1, the direction A2, and the direction A3 in this order for a predetermined period of time. With this processing, the filter 9, the supply flow path 16, the filter chamber 8, and the like are cleaned together with the ink I. The method for cleaning the filter 9 in the embodiment is ended with completion of this step.

[0134] As described above, the printing apparatus 1 in the embodiment includes the cleaning liquid supply unit 44 capable of supplying the cleaning liquid as the liquid to the supply flow path 16 while switching the liquid from the ink I between the accommodation portion 2 and the filter 9 in the supply flow path 16, wherein the valve 15 is capable of switching the cleaning liquid to pass through the formation position of the filter 9 and flow to the branch flow path 17 (corresponding to step S140), the rotation unit 10 is capable of changing the posture of the filter 9 (corresponding to step S150), and the cleaning liquid is capable of being made to flow to the branch flow path 17 (corresponding to step S160). The printing apparatus 1

in the embodiment has this configuration and the filter 9 is thereby cleaned with the cleaning liquid. Therefore, mixing of the foreign matters into the discharging unit 12 can be effectively suppressed. Furthermore, consumption of the ink I can also be suppressed.

[0135] It is needless to say that the invention is not limited by the above-described embodiments and can be made to variously vary in a scope of the invention described in the scope of the invention, and the variations are also encompassed in the scope of the invention.

[0136] For example, in the configuration in which the filter 9 can be cleaned with the cleaning liquid as in the printing apparatus 1 in the second embodiment, the filter 9 may not be inverted during the cleaning of the filter 9 when the controller 33 determines that the flowing degree does not satisfy the predetermined flowing degree. As a reason for this, the cleaning liquid can dissolve the crystals and the like of the colorants of the ink I as the foreign matters. Therefore, only when the cleaning liquid flows in a state of touching the filter 9, the foreign matters can be removed.

[0137] Moreover, when the controller 33 determines that the flowing degree does not satisfy the predetermined flowing degree, a determination result may be notified to the user and the user may invert the filter 9 manually without causing the rotation unit 10 to invert the filter 9 automatically.

[0138] The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention as defined by the claims.

Claims

1. A liquid discharging apparatus (1) comprising:

a supply flow path (16) through which ink (I) as liquid is supplied to a discharging unit (12) from an accommodation portion (2) of the ink;
a sheet-like filter (9) arranged in the supply flow path;
a posture changing unit (10) capable of changing a posture of the filter such that the filter is inverted;
a branch flow path (17) provided between the filter and the discharging unit in the supply flow path; and
a switching unit (15) capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path.

2. A liquid discharging apparatus (1) comprising:

a supply flow path (16) through which ink (I) as

- liquid is supplied to a discharging unit (12) from an accommodation portion (2) of the ink;
 a sheet-like filter (9) arranged in the supply flow path;
 a posture changing unit (10) capable of changing a posture of the filter;
 a determination unit (33) determining a flowing degree of the liquid flowing in the supply flow path;
 a branch flow path (17) provided between the filter and the discharging unit in the supply flow path, and
 a switching unit (15) capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path,
 wherein the liquid discharging apparatus is arranged such that, in response to the determination unit determining that the flowing degree does not satisfy a predetermined flowing degree, the switching unit switches the liquid which has passed through the formation position of the filter to flow to the branch flow path, and the posture changing unit changes the posture of the filter.
3. The liquid discharging apparatus according to Claim 2,
 wherein the posture changing unit is capable of inverting the filter, and
 wherein the liquid discharging apparatus is arranged such that, in response to the determination unit determining that the flowing degree does not satisfy the predetermined flowing degree, the posture changing unit inverts the filter.
 4. The liquid discharging apparatus according to Claim 2 or Claim 3, including a pressure detector (6; 11) in the supply flow path,
 wherein the determination unit determines the flowing degree of the liquid which flows while passing through the formation position of the filter based on a detection result by the pressure detector.
 5. The liquid discharging apparatus according to Claim 4, including two pressure detectors (6, 11) in the supply flow path with the filter interposed between the pressure detectors,
 wherein the determination unit determines the flowing degree of the liquid which flows while passing through the formation position of the filter based on a difference between pressures detected by the two pressure detectors.
 6. The liquid discharging apparatus according to any one of Claims 3 to 5,
 wherein when the determination unit determines that the flowing degree currently satisfies the predetermined flowing degree after determining that the flowing degree does not satisfy the predetermined flowing degree, the posture changing unit returns the posture of the filter and the switching unit switches the flowing liquid which has passed through the formation position of the filter to flow to the discharging unit.
 7. The liquid discharging apparatus according to any one of Claims 2 to 6,
 wherein when the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree, the flowing liquid which has passed through the formation position of the filter is made to flow to the branch flow path for a predetermined period of time.
 8. The liquid discharging apparatus according to any one of Claims 2 to 7,
 wherein the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree based on lapse of a predetermined period of time from a previous change of the posture of the filter.
 9. The liquid discharging apparatus according to any one of Claims 2 to 8, including a calculation unit (33) calculating an amount of the ink flowing in the supply flow path,
 wherein the determination unit determines that the flowing degree does not satisfy the predetermined flowing degree based on a calculation result by the calculation unit, which indicates passage of a predetermined amount of the ink through the formation position of the filter after change of the posture of the filter.
 10. The liquid discharging apparatus according to any one of the preceding claims,
 wherein the switching unit is capable of switching the ink to flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the ink is capable of being made to flow to the branch flow path.
 11. The liquid discharging apparatus according to any one of Claim 1 to 9, including a cleaning liquid supply unit (44) capable of supplying cleaning liquid as the liquid to the supply flow path while switching the liquid from the ink between the accommodation portion and the filter in the supply flow path,
 wherein the switching unit is capable of switching the cleaning liquid to pass through the formation position of the filter and flow to the branch flow path, the posture changing unit is capable of changing the posture of the filter, and the cleaning liquid is capable of being made to flow to the branch flow path.

12. A method for cleaning a filter (9) in a liquid discharging apparatus (1) that includes a supply flow path (16) through which ink (I) as liquid is supplied to a discharging unit (12) from an accommodation portion of the ink, the sheet-like filter arranged in the supply flow path, a posture changing unit (10) capable of inverting the filter, a branch flow path (17) provided between the filter and the discharging unit in the supply flow path, and a switching unit (15) capable of switching to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, the method comprising:

switching, by the switching unit, the liquid which has passed through the formation position of the filter to flow to the branch flow path, inverting, by the posture changing unit, the filter, and making the liquid which has passed through the formation position of the filter flow to the branch flow path.

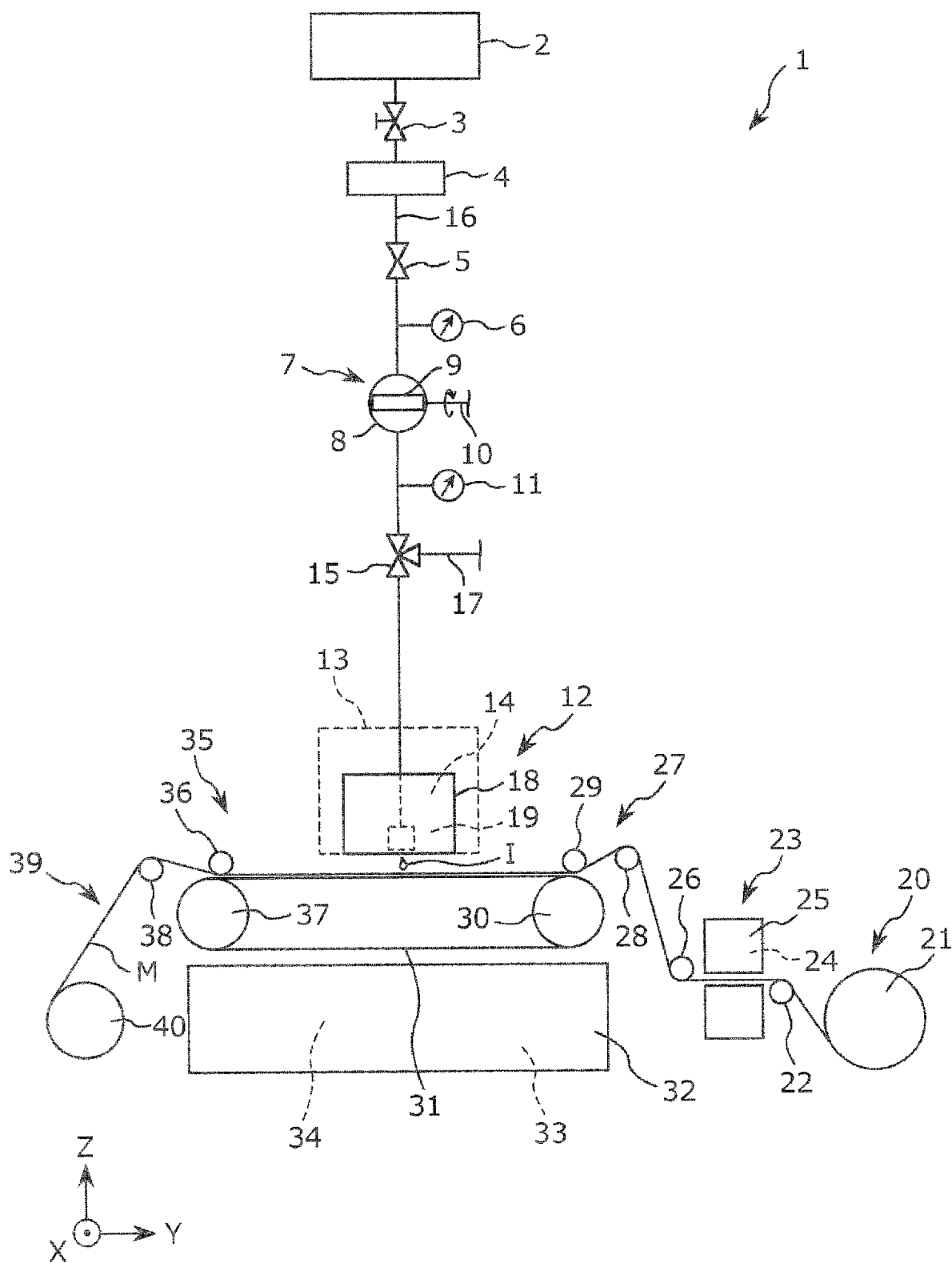
13. A method for cleaning a filter (9) in a liquid discharging apparatus (1) that includes a supply flow path (16) through which ink (I) as liquid is supplied to a discharging unit from an accommodation portion of the ink, the sheet-like filter arranged in the supply flow path, a posture changing unit (10) capable of changing a posture of the filter, a branch flow path (17) provided between the filter and the discharging unit in the supply flow path, and a switching unit (15) capable of switching whether to make the flowing liquid which has passed through a formation position of the filter flow whether to the discharging unit or to the branch flow path, the method comprising:

determining a flowing degree of the liquid flowing in the supply flow path, and when it is determined that the flowing degree does not satisfy a predetermined flowing degree, switching, by the switching unit, the liquid which has passed through the formation position of the filter to flow to the branch flow path, changing, by the posture changing unit, the posture of the filter, and making the liquid which has passed through the formation position of the filter flow to the branch flow path.

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FIG. 1



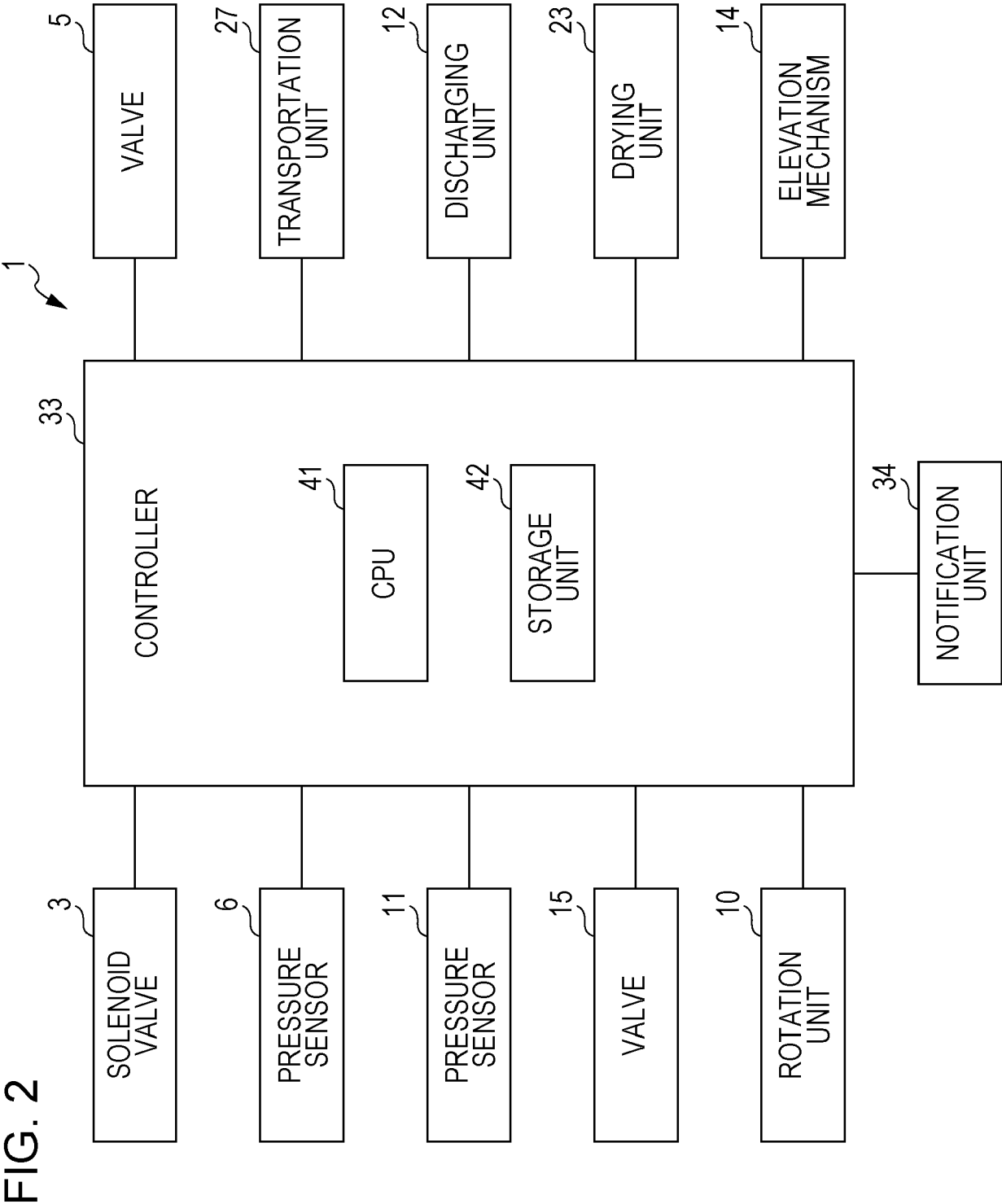


FIG. 3

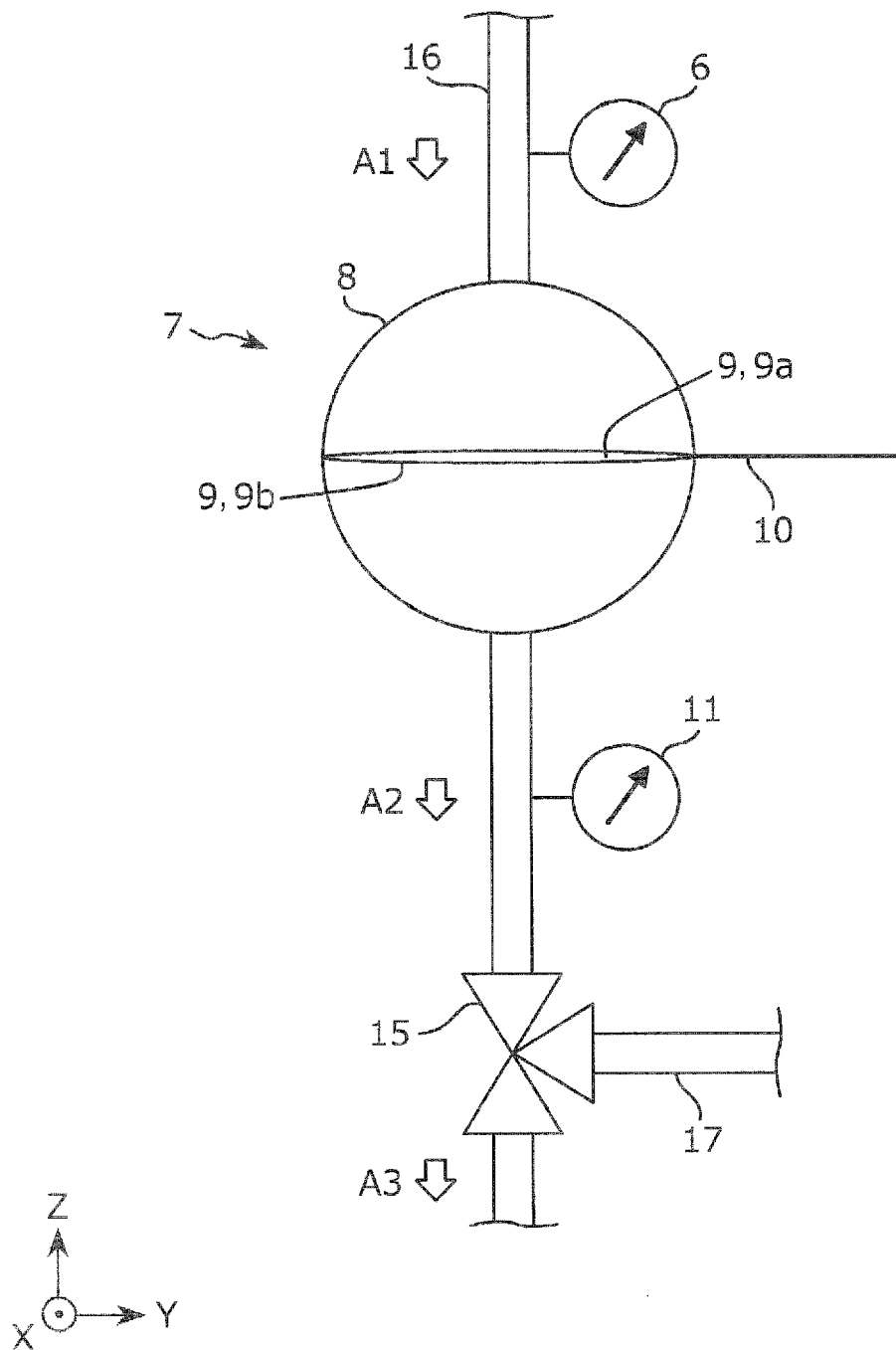


FIG. 4

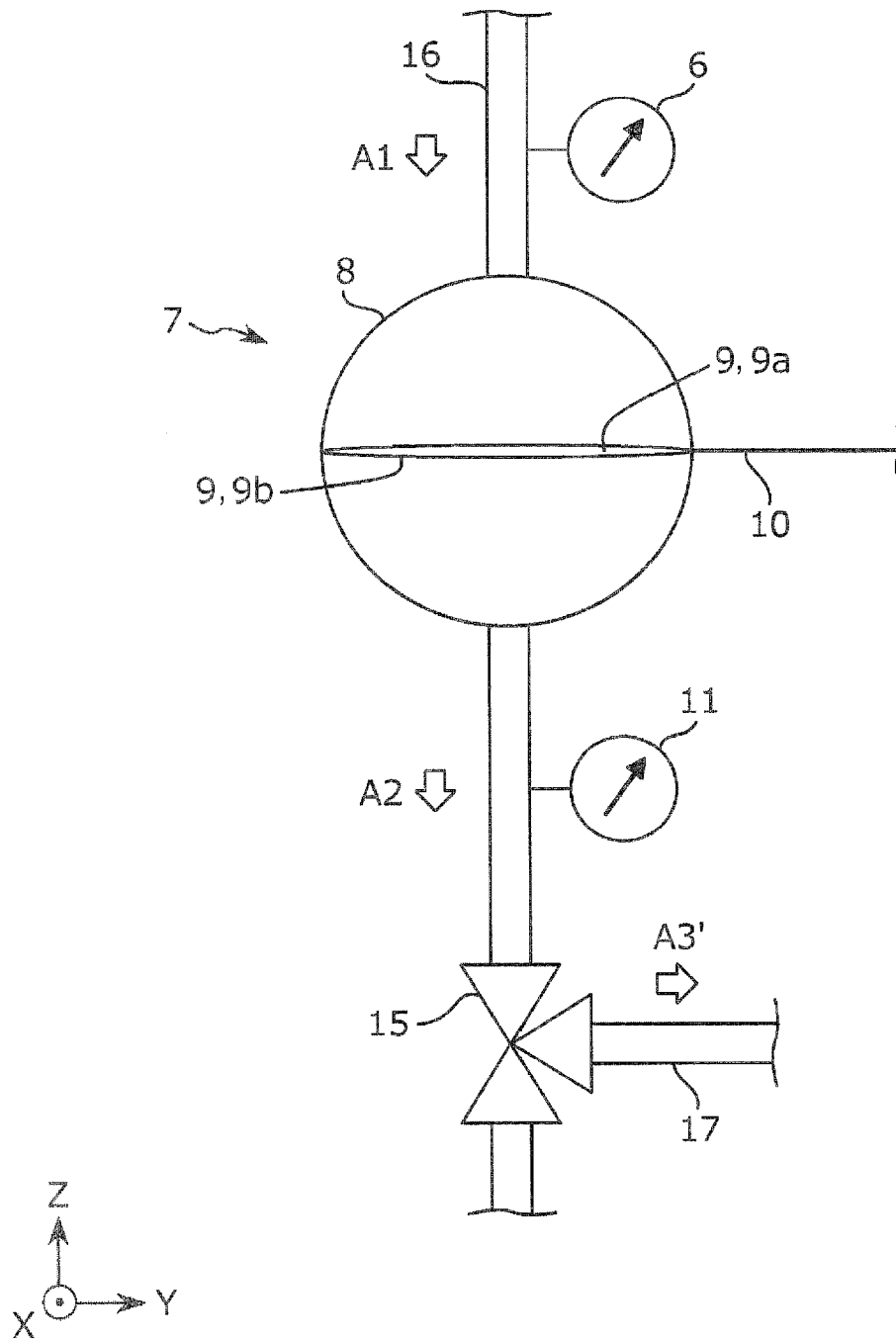


FIG. 5

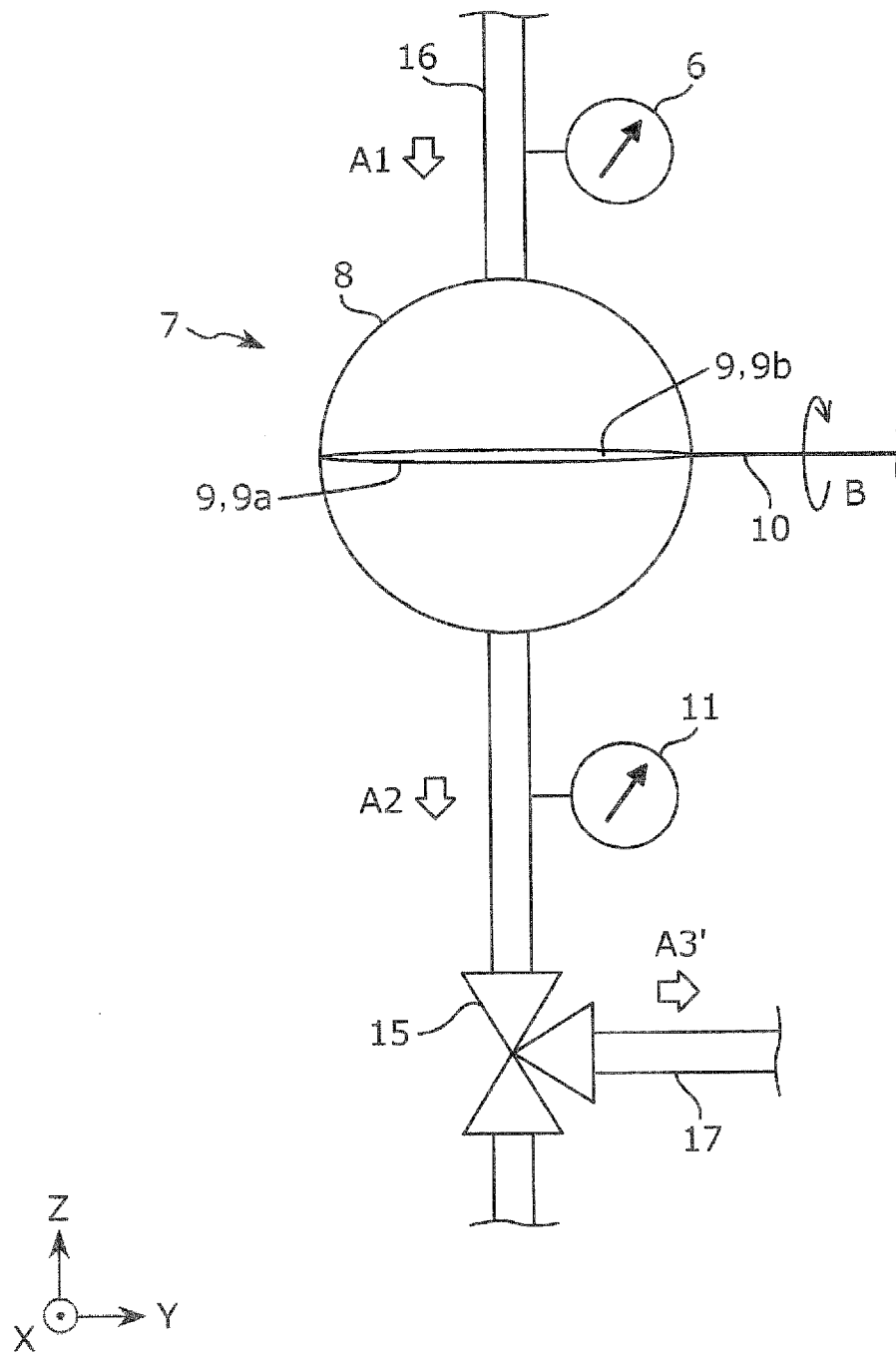


FIG. 6

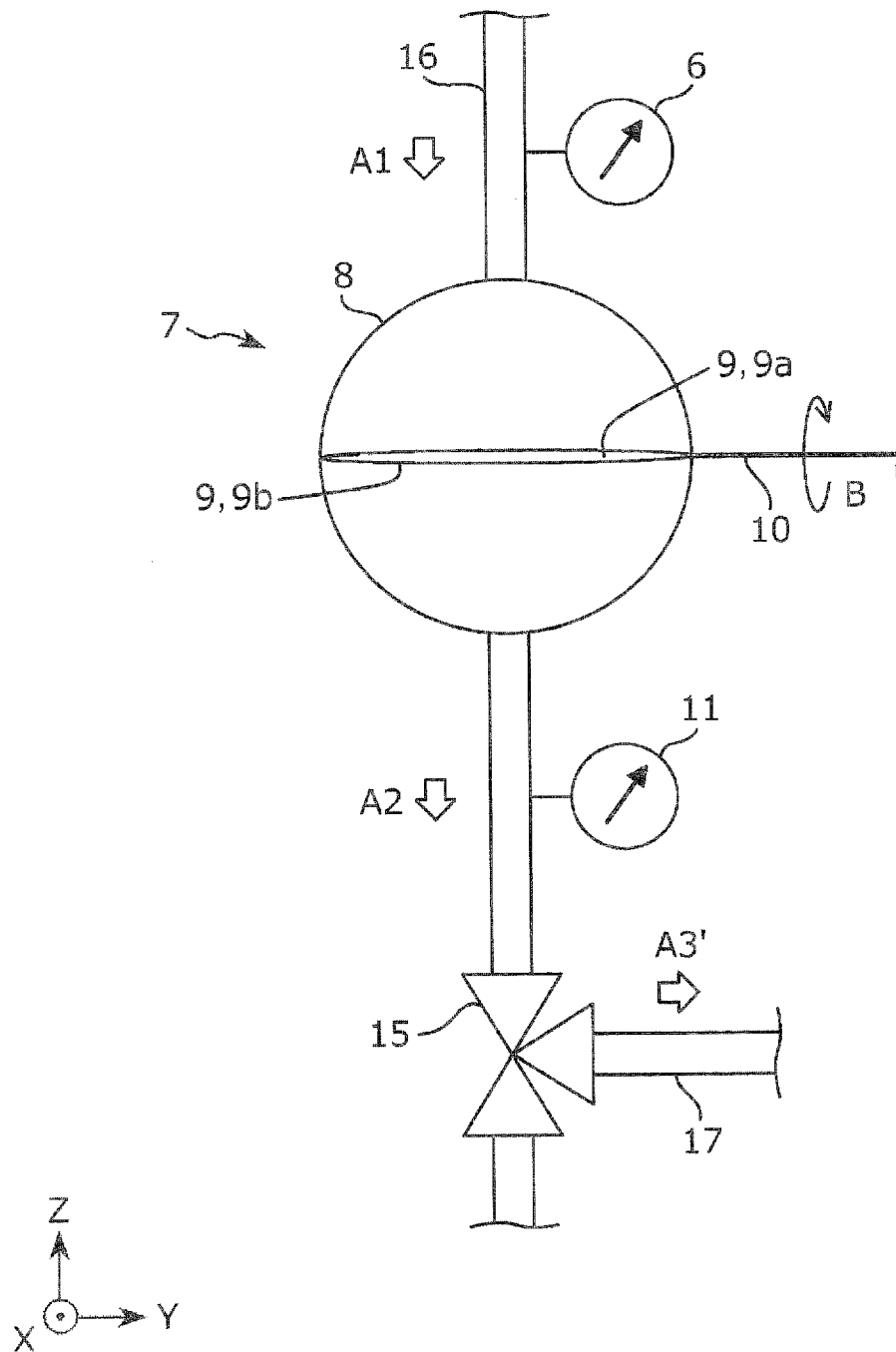


FIG. 7

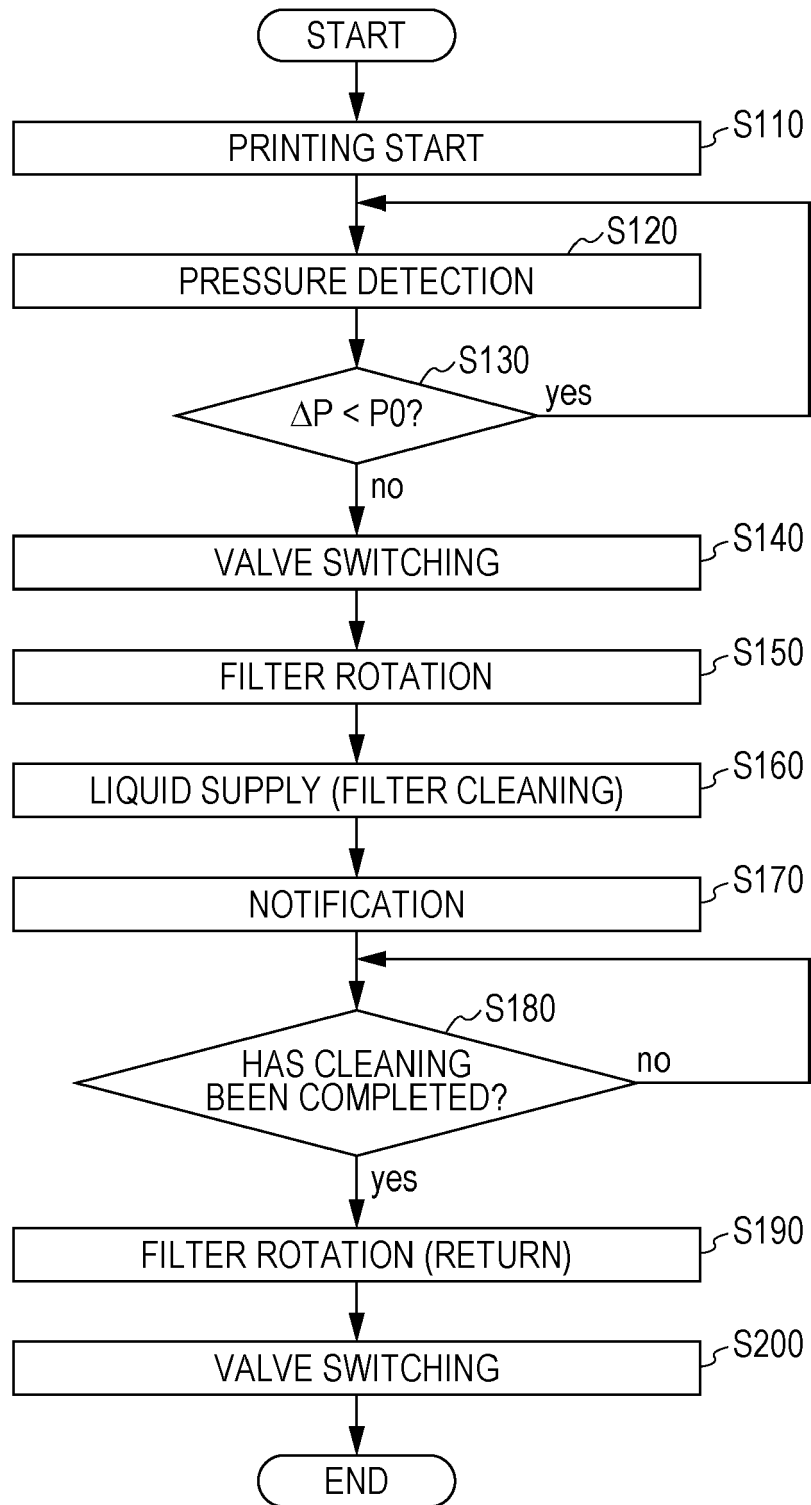


FIG. 8

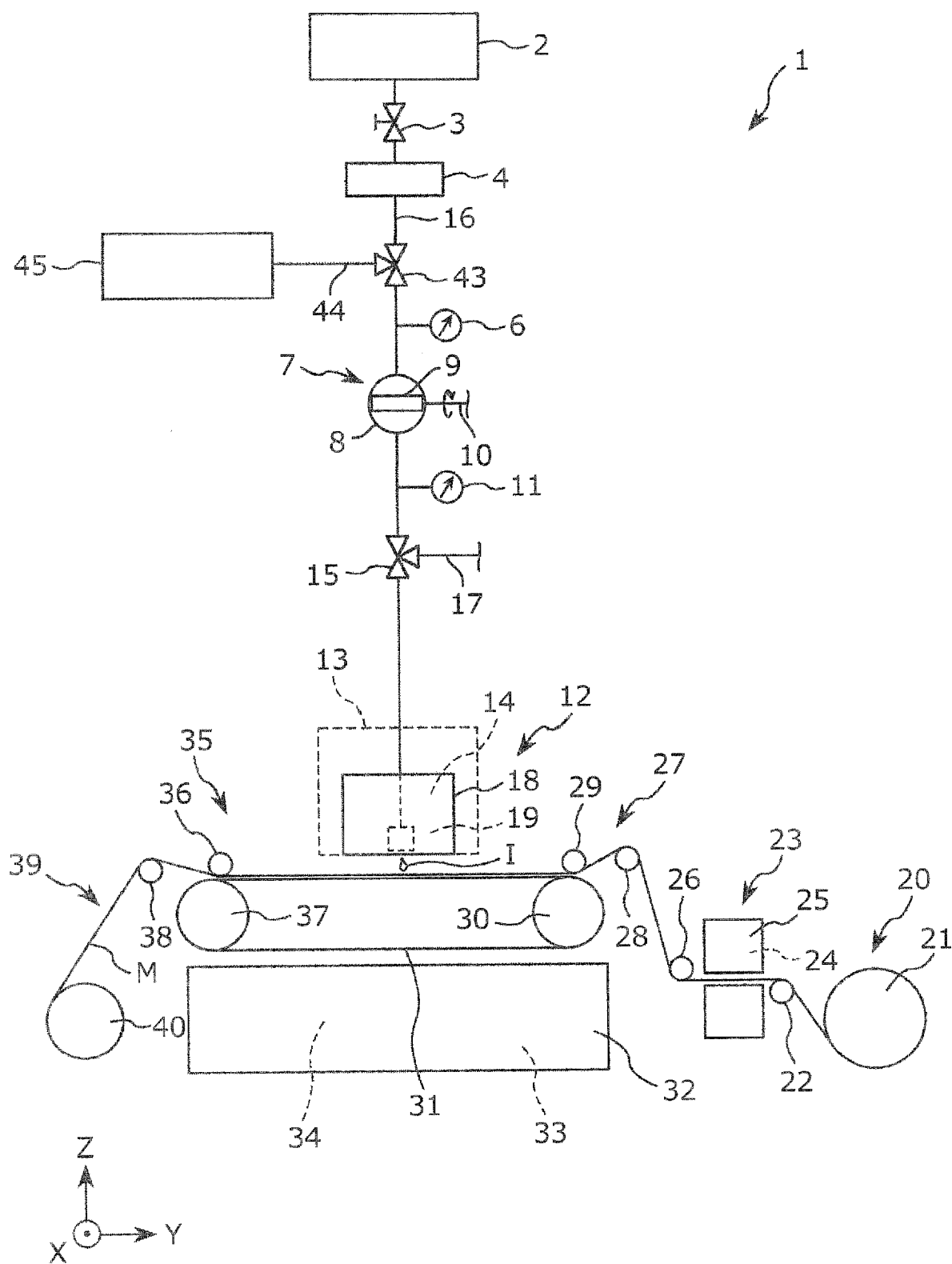


FIG. 9

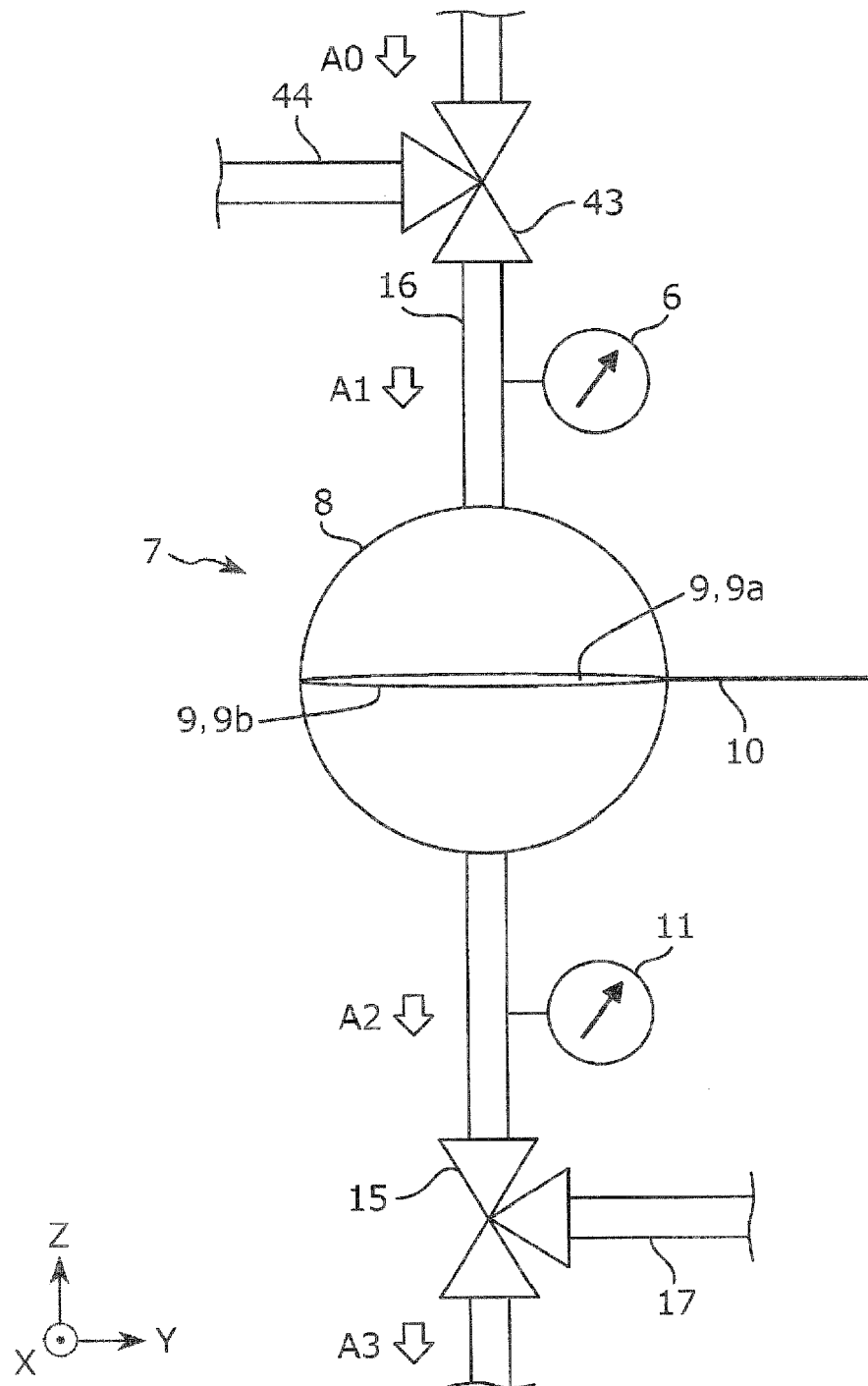


FIG. 10

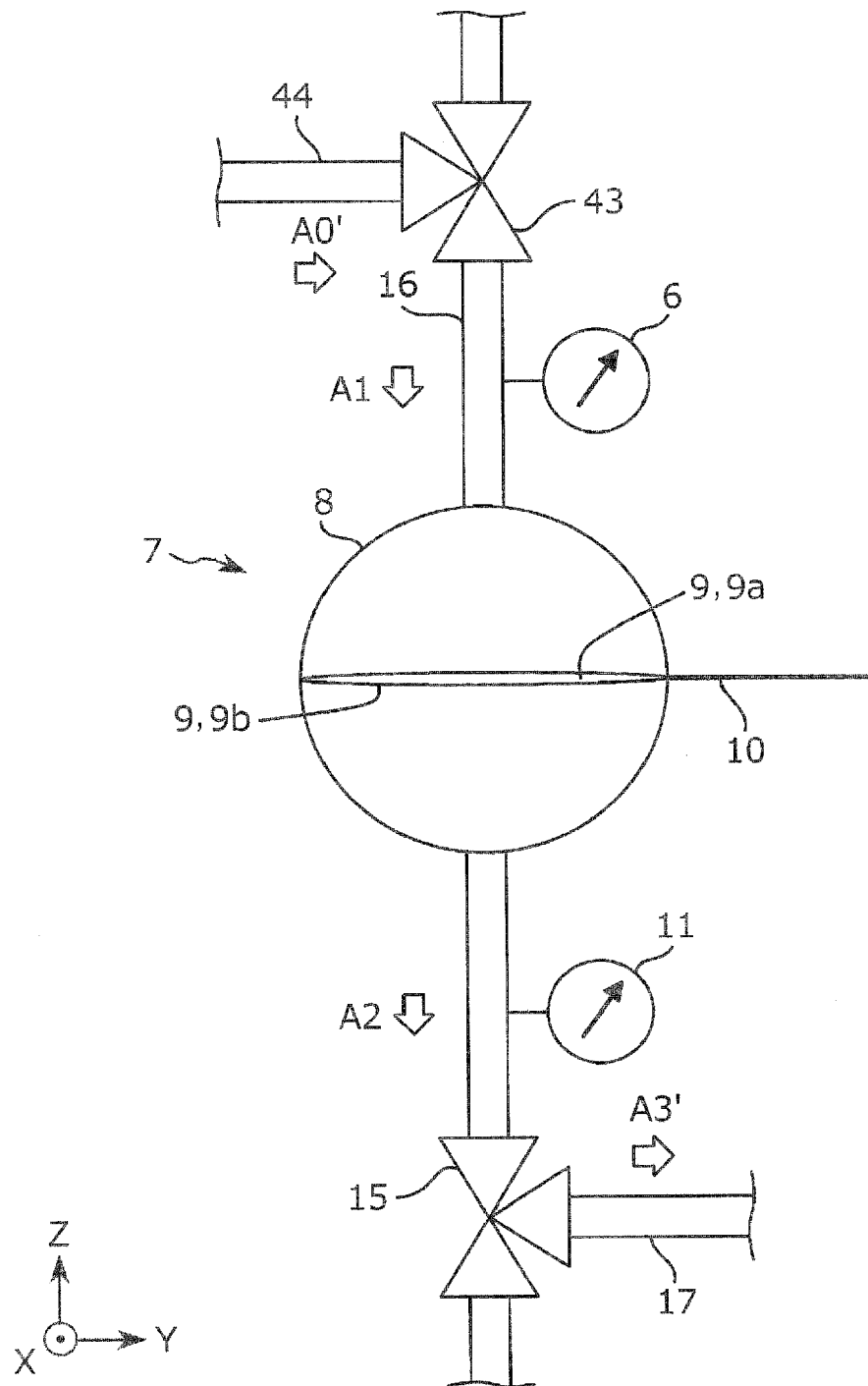


FIG. 11

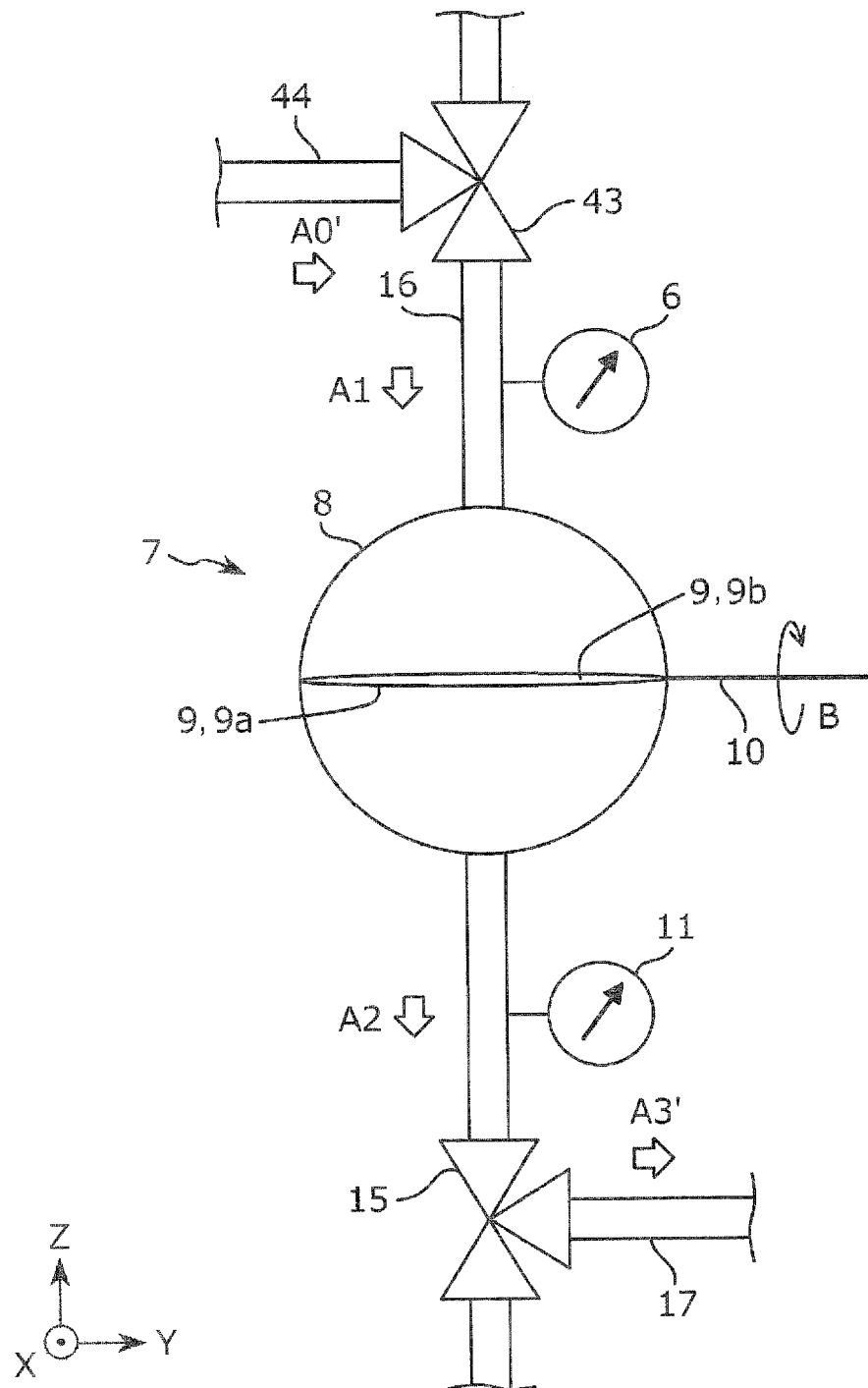


FIG. 12

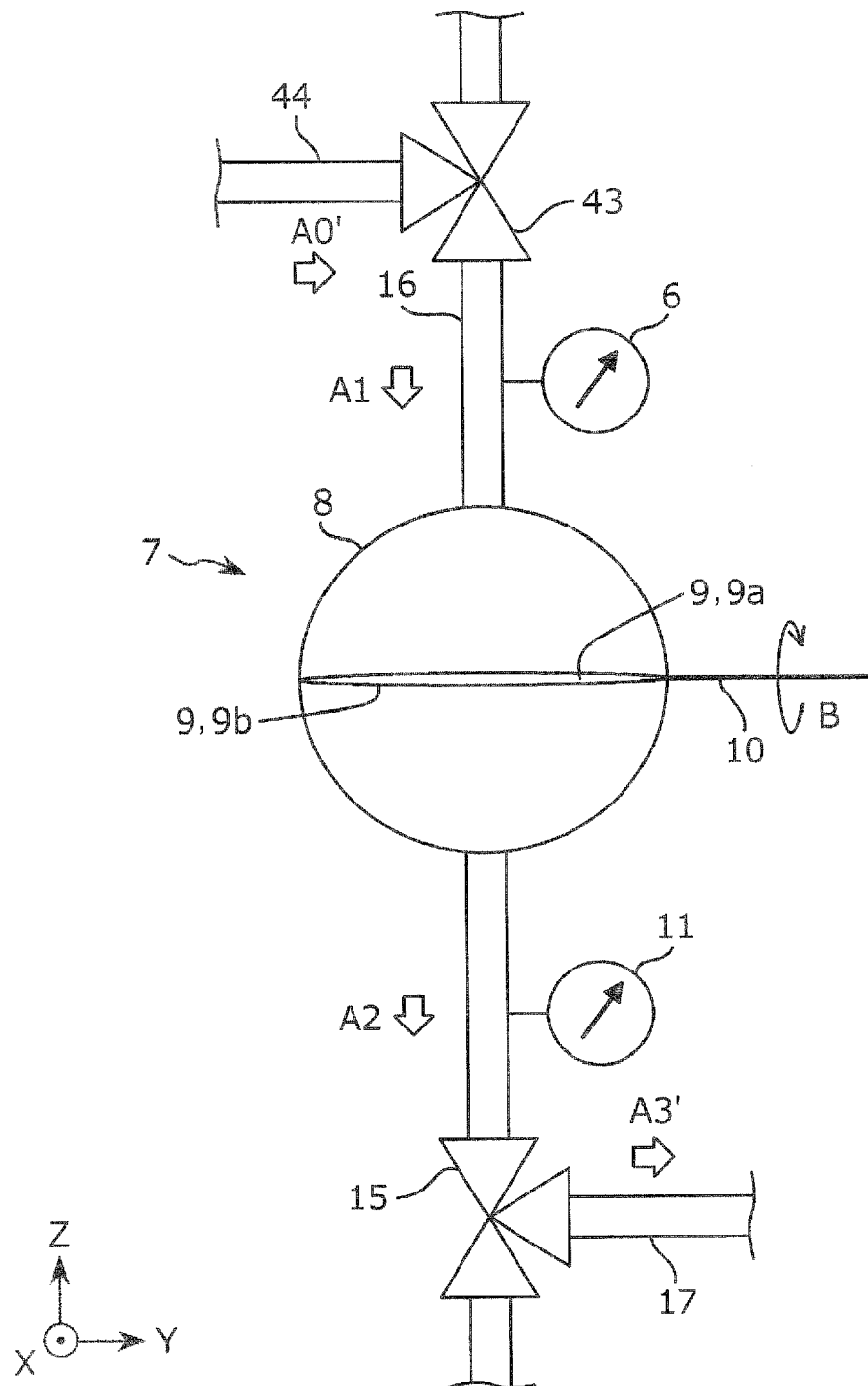
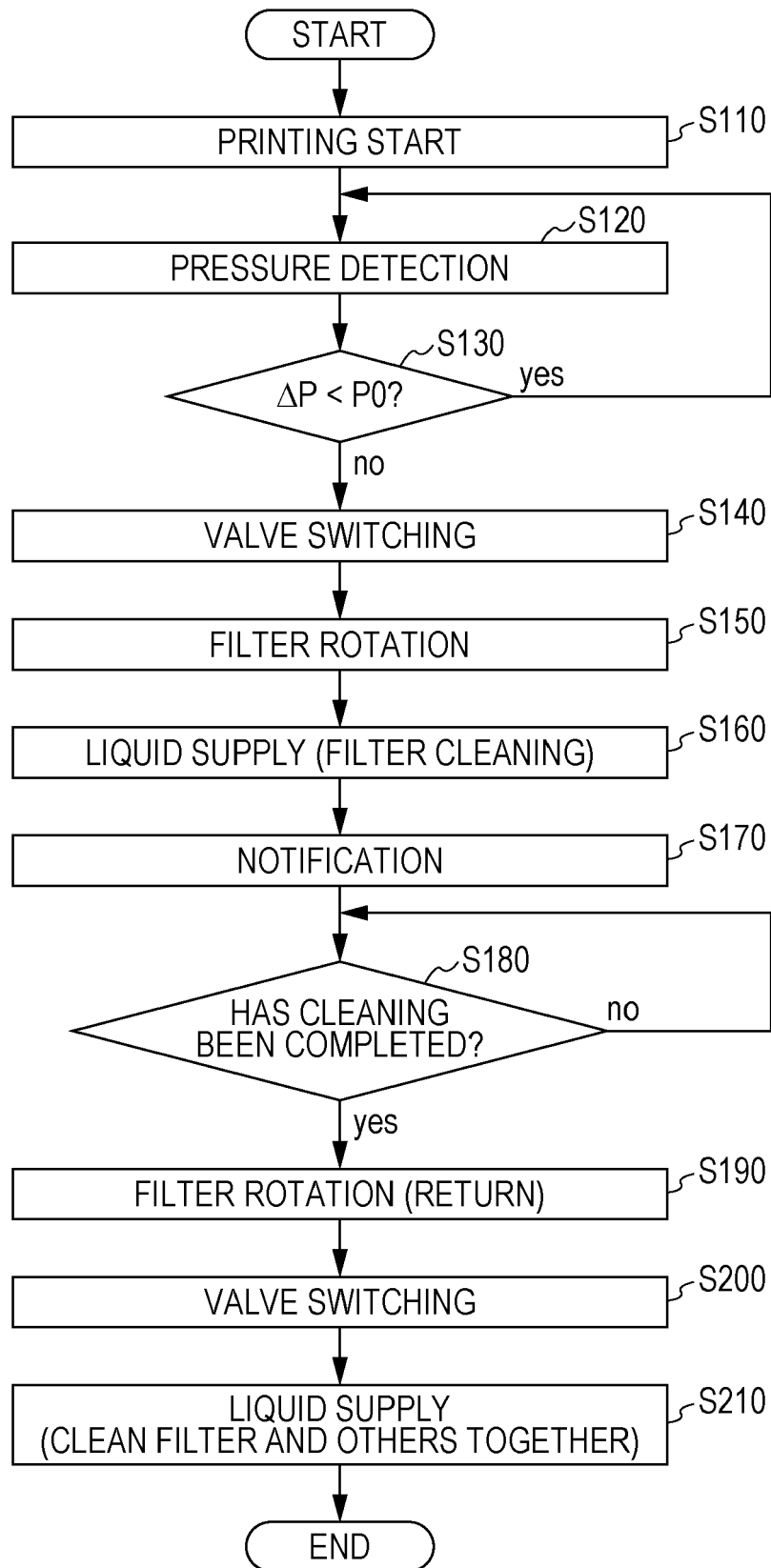


FIG. 13





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Place of search The Hague		Date of completion of the search 28 June 2018	Examiner Cavia Del Olmo, D
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