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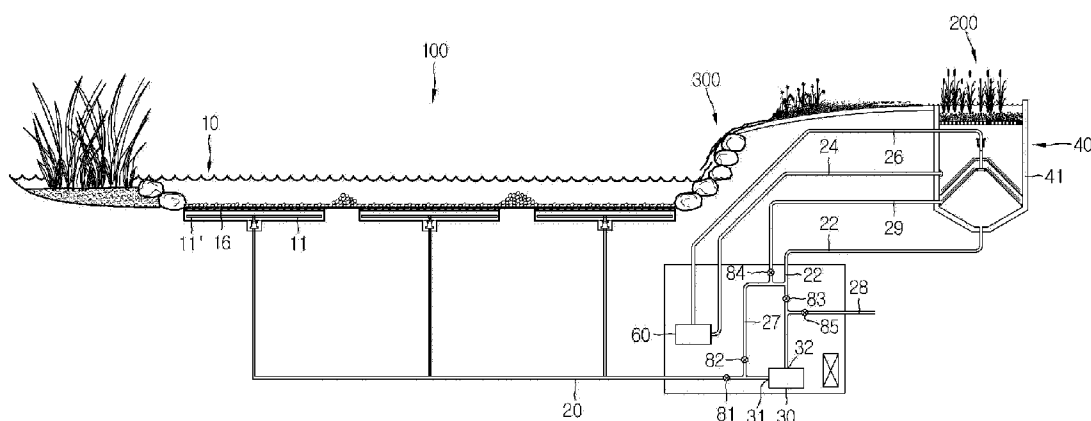
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(54) Title: APPARATUS AND SYSTEM FOR FILTERING WATER FOR PURIFICATION



(57) Abstract: Disclosed are an apparatus and a system for filtering water for purification including a filter case having an inflow port formed in a lower end thereof; at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the filter case to an upper portion of the filter case; and an injection unit for ejecting the filtered water toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane, wherein the water containing the pollutants flows through the inflow port into the filter case, and then is filtered through the filter membrane and discharged through the open upper side during a filtering operation, and wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during an operation for discharging the pollutants.

Description

APPARATUS AND SYSTEM FOR FILTERING WATER FOR PURIFICATION

Technical Field

- [1] The present invention relates to an apparatus and a system for filtering water for purification, and more particularly to an apparatus and a system for filtering water for purification capable of effectively removing precipitated or deposited sludges present in water bodies of closed water areas such as ponds.

Background Art

- [2] Generally, continuous inflow water runs short or hardly exists in most closed water areas such as naturally or artificially created reservoirs or ponds. If an increase of spontaneously occurring pollutants and pollutants flowing in from the outside exceeds a natural self-purification capacity in a water body of such a closed water area itself, the water is severely polluted, resulting in accumulation of various precipitated or deposited sludges on a bottom of a pond.
- [3] Since the accumulated pollutants become decayed or rise to the water surface as time passes, they have bad smells, contaminate water, and also destroy the scenic beauty. Accordingly, there has been an absolute demand for continuously removing the precipitated or deposited sludge.
- [4] The conventional method for removing precipitated or deposited sludge includes a method for draining out water from a related water area and dredging the water area, a method for exhausting out water of a related water area using a suction apparatus, etc. However, these methods have disadvantages that they require enormous manpower, time and cost, and pollutants should be also periodically removed therefrom since they are increasingly accumulated again as time passes.
- [5] As other conventional methods, there have been attempts to remove precipitates by adding chemical medicines or injecting air in water to float the precipitates. However, the method has disadvantages that its efficiency of removing pollutants is significantly low if a water area is very wide, and it is very uneconomical since an apparatus for injecting chemicals and air and an apparatus for removing floating materials should be installed additionally.
- [6] Considering the above contexts, there has been proposed an apparatus for collecting sludge at all times to purify water of a closed water area. According to such an apparatus, a plurality of intakes are installed in a bottom of a pond, and then connected with an apparatus for purifying water through an underground piping. Accordingly, the apparatus purifies water by sucking precipitates along with water through the intakes at

all times.

[7] However, the above apparatus also has a problem that, since sludge is sucked along with water through intakes having a narrow diameter, the sludge can be removed in an adjacent region of the intakes but not removed in a remote region from the intakes. In order to solve the problem, a large number of intakes may be installed in a bottom of a pond, but this is very uneconomical, and, in particular, may severely damage water landscapes.

[8] Also, the filtered pollutants or sludge is intactly deposited on a sand layer in a bottom of a pond since the conventional system for purifying water employs a so-called "downward" filtration method in which a contaminated water is filtered by percolating into a basal layer. Accordingly, the bottom of the purified water area may be contaminated seriously, which causes bad smells or destroys water landscapes. In addition, if water is forced to flow backward for the purpose of periodically removing deposited pollutants, the purified water area is more severely contaminated while the deposited pollutants or sludge rises to the water surface of a pond, and its removal efficiency is significantly reduced, as well as this method is very uneconomical since a large amount of water is used for removing the sludge.

[9] An automatic multi-layered pressure filter has been used as another example of the conventional methods known in the art. According to an operation of the filter, if a mixing water of sludges sucked by a pump flows through an upper portion of the filter, water flows downward through filter layers by a hydraulic pressure, and simultaneously pollutant materials are filtered by the filter layers. In this case, a filtration efficiency is reduced since pollutant materials close the filter layers as the pollutant materials continues to be filtered, and therefore a large amount of water is also used since water is forced to flow backward so as to remove the pollutant materials.

[10] For such a filtration apparatus, the filter layers can not be washed while filtering the water. Accordingly, if the filter layers are closed by pollutant materials such as sludges and so on, they should be washed with a backwashing operation after a filtration operation is suspended.

[11]

Disclosure of Invention

Technical Problem

[12] Accordingly, the present invention is designed to solve the problems of the prior art, and therefore it is an object of the present invention to provide a system for filtering water for purification using a sludge intake apparatus capable of effectively removing sludges deposited in water from a broader region of a closed water area.

[13] It is another object of the present invention to provide an apparatus for filtering

water for purification capable of effectively removing sludges or pollutants present in water without contaminating water of purified water areas by using an upflow filtration method having a rotary multi-layer structure.

[14] It is still another object of the present invention to provide an apparatus for filtering water for purification capable of preventing filter membranes from being closed by pollutants such as sludges, etc. by continuously washing a filter membrane together with filtering water.

[15] It is yet another object of the present invention to provide a system for filtering water for purification using such an apparatus.

Technical Solution

[16] In order to accomplish the above object, the present invention provides an apparatus for filtering water for purification including a filter case having an inflow port formed in a lower end thereof and whose upper side is open; at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the filter case to an upper portion of the filter case so that an upper space and a lower space can be separated in the inside of the filter case; and an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane, wherein the water containing the pollutants flows through the inflow port into the filter case, and then is filtered through the filter membrane and discharged through the open upper side during a filtering operation, and wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.

[17] Preferably, the apparatus for filtering water for purification further includes an auxiliary drain pipe for draining the pollutants accumulated in a concentration zone (S2) between the filter membranes.

[18] Preferably, the filter membrane has a form of an erect cone. In this case, the apparatus for filtering water for purification further includes drain rings installed along an edge of an outer circumferential end of the filter membranes to be communicated with the auxiliary drain pipe and having a plurality of drain holes formed for draining pollutants of the concentration zone (S2).

[19] As an alternative, the filter membrane has a form of an inverted cone. In this case, a discharge hole is apically formed in a central region of the lowest filter membrane, and an end of the auxiliary drain pipe is connected to the discharge hole.

[20] According to the present invention, the injection unit includes a plurality of injection pipes rotationally installed in an upper portion of the filter membrane and having a plurality of nozzles formed for ejecting water toward the filter membrane,

wherein the nozzles are formed to be inclined aslant in one direction toward the filter membrane.

- [21] More preferably, the injection unit includes an intake piping connected to the filter case to intake water of a purification zone (S3) filtered through the filter membrane; an injection piping extended to an upper portion of a filter membrane inside the filter case; a pump for applying a driving force so that water sucked through the intake piping can flow into the injection piping; and a rotary connection unit for rotationally coupling the injection pipe with an end of the injection piping.
- [22] According to another embodiment of the present invention, provided is an apparatus for filtering water for purification including a closed housing having an inflow port formed in a lower end thereof and an outlet formed in an upper surface thereof; at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the housing to an upper portion of the housing so that an upper space and a lower space can be separated in the inside of the housing; and an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane, wherein the water containing the pollutants flows through the inflow port into the housing to be filtered through the filter membrane, and then discharged through the outlet during a filtering operation, and wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.
- [23] According to still another embodiment of the present invention, provided is a system for filtering water for purification including a first pump; an intake piping for sucking sludges along with water from a lower water area using a driving force of the first pump; a plurality of intake members whose ends are coupled to be communicated with the intake piping and also rotationally installed in the center of the coupling unit inside a collection orifice formed in a bottom of the lower water area, and having a plurality of intake holes formed for sucking water and sludges inside the collection orifice; a filter case having an inflow port formed for influxing the water and the sludges influxed through the intake piping in a lower end thereof and whose upper side is open; at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the filter case to an upper portion of the filter case so that an upper space and a lower space can be separated in the inside of the filter case; and an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane, wherein the water containing the pollutants flows through the inflow port into the filter case, and then is filtered through the filter membrane and discharged through the open upper side during a filtering operation, and wherein

pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.

[24] Preferably, the intake members are hollow cylindrical pipes, and the intake holes are formed to be inclined aslant in one direction toward the intake member.

[25] More preferably, the system for filtering water for purification of the present invention includes a coupling member coupled with an end of the intake member and also rotationally coupled with the intake piping so that the intake member can be communicated with the intake piping; and a rotary connection unit interposed between the coupling member and the intake piping to be rotationally coupled with each other.

[26] According to yet another embodiment of the present invention, provided is a system for filtering water for purification including a first pump; an intake piping for sucking sludges along with water from a lower water area using a driving force of the first pump; a plurality of intake members whose ends are coupled to be communicated with the intake piping and also rotationally installed in the center of the coupling unit inside a collection orifice formed in a bottom of the lower water area, and having a plurality of intake holes formed for sucking water and sludges inside the collection orifice; a closed housing having an inflow port formed for influxing the water and the sludges influxed through the intake piping in a lower end thereof, and an outlet formed in an upper surface thereof; at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the housing to an upper portion of the housing so that an upper space and a lower space can be separated in the inside of the housing; and an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane, wherein the water containing the pollutants flows through the inflow port into the housing to be filtered through the filter membrane, and then discharged through the outlet during a filtering operation, and wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.

[27]

Brief Description of the Drawings

[28] Fig. 1 is a schematic view showing a system for filtering water for purification according to a preferred embodiment of the present invention.

[29] Fig. 2 is a cross-sectional view schematically showing a sludge intake apparatus in a system for filtering water for purification according to a preferred embodiment of the present invention.

[30] Fig. 3 is a plane view schematically showing a sludge intake apparatus in the

system for filtering water for purification according to the preferred embodiment of the present invention.

[31] Fig. 4 is a cross-sectional view schematically showing a coupling unit in the sludge intake apparatus of a system for filtering water for purification according to the preferred embodiment of the present invention.

[32] Fig. 5 is a side view schematically showing the system for filtering water for purification according to the preferred embodiment of the present invention.

[33] Fig. 6 is a cross-sectional view taken along a line III-III' of Fig. 5.

[34] Fig. 7 is a cross-sectional view schematically showing an injection unit and a rotary connection unit in the system for filtering water for purification according to the preferred embodiment of the present invention.

[35] Fig. 8 is a schematic view showing an apparatus for filtering water for purification according to another preferred embodiment of the present invention.

[36] Fig. 9 is a cross-sectional view schematically showing an apparatus for filtering water for purification according to another preferred embodiment of the present invention.

[37] Fig. 10 is a cross-sectional view schematically showing an apparatus for filtering water for purification according to another preferred embodiment of the present invention.

[38] Fig. 11 is a cross-sectional view schematically showing an apparatus for filtering water for purification according to another preferred embodiment of the present invention.

Best Mode for Carrying Out the Invention

[39] Fig. 1 shows a schematic configuration of a system for filtering water for purification according to a preferred embodiment of the present invention.

[40] Referring to Fig. 1, the system for filtering water for purification of the present invention is installed in closed water areas, for example ponds. The ponds may be classified into a lower water area 100 containing most of water and having a relatively lower water surface, an upper water area or a purified water area 200 positioned in a partial region having a relatively higher water surface than the lower water area 100. The upper water area 200 and the lower water area 100 are connected with each other by a stepped water area 300 present between them, and the water flows from the upper water area 200 to the lower water area 100.

[41] The system for filtering water for purification according to the present invention includes a plurality of sludge intake apparatuses 10 installed in the lower water area 100, and a water filtering apparatus 40, which filters sludges sucked by the sludge intake apparatus 10.

- [42] A plurality of the sludge intake apparatuses 10 may be installed spaced apart from a bottom of the pond, and the interval and number of the sludge intake apparatuses 10 are suitably selected according to a pollution level and a self-purification capacity of water, a size of a water area, etc.
- [43] Figs. 2 and 3 show a more detailed configuration of the sludge intake apparatus 10 according to the preferred embodiment of the present invention. As shown in Figs. 2 and 3, a collection orifice 110 having a predetermined depth is formed in the bottom of a pond, and a sludge intake apparatus 10 is installed inside the collection orifice 110. The collection orifice 110 may be constructed by casting concrete or installing separate structure.
- [44] Specifically, the sludge intake apparatus 10 includes a plurality of intake members 11, 11' that are rotationally installed inside the collection orifice 110 with being spaced at a predetermined distance from a bottom of the collection orifice 110. Two symmetrically arranged intake members are illustrated in this embodiment, but the present invention is not limited thereto, and the intake members may be arranged in three, four or more.
- [45] Preferably, the intake members 11, 11' are hollow cylindrical pipes, and a plurality of intake holes 12a, 12b are formed in side surfaces of the intake members 11, 11'. It goes without saying that cylindrical pipes as well as pipes having polygonal sections may be used as the intake members 11, 11'. According to the present invention, the intake holes 12a, 12b are all formed in one direction (e.g., in a counterclockwise direction as illustrated in this embodiment). This is for the purpose of rotating the intake members 11, 11' by means of the reaction generated when water and sludge are sucked through the first and second intake holes 12a, 12b, as described later.
- [46] According to the preferred embodiment of the present invention, the intake holes 12a, 12b may be formed to be inclined obliquely along a circumferential direction of the intake members 11, 11'.
- [47] According to the preferred embodiment of the present invention, the intake holes 12a, 12b may be formed to be inclined obliquely along one direction to the intake members 11, 11', and more preferably formed to be inclined aslant downward or upward, for example at 45°. At this time, inclined angles of the intake holes may be suitably selected so that the intake members 11, 11' can be rotated by reaction to intake, considering an efficiency to intake sludges.
- [48] Also, one of ends of the intake members 11, 11' is coupled to be communicated with an intake piping 20 connected with a pump 30 (see FIG. 1), wherein the intake members 11, 11' are coupled to be rotatable based on a coupling portion of the intake piping 20. According to the present invention, the intake members 11, 11' may be coupled with the intake piping 20 by means of a rotary connection unit 13, as shown in

FIG. 4. The intake members 11, 11' may be integrally formed, or integrated by means of a coupling member 11a. In this case, the coupling member 11a may be rotationally coupled with the intake piping 20.

[49] The rotary connection unit 13 includes a bush 13a coupled with an end of the intake piping 20 so that it can be communicated with the intake piping 30; and a rotary tube 13b coupled to be rotatable in the bush 13a and coupled to be communicated with an end of the intake members 11, 11' or the coupling member 11a.

[50] At the end of the rotary tube 13b, formed is a bracket 13c, which is then coupled with a bracket 11b formed at the end of the coupling member 11a using a coupling means such as a bolt 15a. Also at the end of the bush 13a, a bracket 13d may be formed, which may be then coupled with a bracket 30a formed at the end of the intake piping 20 using a bolt 15b.

[51] A bearing 13e such as a sliding bearing is interposed, for example, between the bush 13a and the rotary tube 13b so that the bush 13a and the rotary tube 13b can be rotated against each other. In order to support the weight of the rotary tube 13b, an additional bearing 13f may be preferably interposed at a lower end of the rotary tube 13b to smoothly support rotation of the rotary tube 13b.

[52] More preferably, the rotary connection unit may be easily exchanged according to damage of the bearing and expiration of a service life since it may be assembled or disassembled as one part for the intake member and the intake piping.

[53] Although the coupling between the intake member 11 and the intake piping 20 has been described in detail in this embodiment, it should be understood that the present invention is not limited to the embodiment, and any of the conventional configurations may be applied if an intake member may be configured to be rotationally coupled with the intake piping.

[54] As shown in FIG. 2, a strainer 16 may be installed in an opening of the collection orifice 110 formed on the intake members 11, 11' to cover the collection orifice 110. The strainer 16 prevents the intake members 11, 11' from being damaged by collision with stones, pebbles, or other relatively large foreign substances. Further, the strainer 16 may be covered up with pebbles on it, as shown in FIG. 3. In this case, the water landscape may be naturally presented since the sludge intake apparatuses installed in the bottom of the pond are not visually viewed from the outsides. Paving such a pebble is no obstacle to water purification because pollutants and sludge in water may flow in through gaps between the pebbles. Rather, an efficiency of purifying water may be improved due to decomposition of the pollutants and the sludge by microorganisms living in surfaces of the pebbles.

[55] More preferably, relatively large stones or pebbles are laid high to create humps among a plurality of sludge intake apparatuses installed in the bottom of the pond, and

therefore pollutants or sludge is naturally induced into the collection orifice 110 of the sludge intake apparatus.

- [56] Referring to Figs. 1 and 2 again, a first pump 30 is connected pipe by pipe with a water filtering apparatus 40 for filtering and separating the introduced sludges, and the apparatus for filtering water for purification 40 forces the water, from which the sludges are filtered and separated, to flow into an upper water area 200.
- [57] Referring to FIG. 5 showing a detailed configuration of the water filtering apparatus 40 according to the present invention, the water filtering apparatus includes a filter case 41 composed of a cylindrical body unit 41a and a hopper-type concentration unit 41b. The concentration unit 41b takes the form of a hopper, and therefore it is arranged so that sludges or pollutants filtered in the filter case 41 can be easily discharged, as described later.
- [58] Preferably, the filter case 41 may be integrally manufactured into a cylindrical stainless steel container and so on, and otherwise constructed using construction materials such as concrete, etc.
- [59] At a bottom of the filter case 41, an inflow port 22a is formed, to which an end of a transfer piping 22 connected with the first pump 30 is connected. Also, an upper end of the filter case 41 is open, in which a strainer 42 having through holes is then installed, and small pebbles and a sand layer which may plant and cultivate aquatic plants are, for example, provided on the strainer 42. According to this embodiment, the filter case 41 is preferably installed into the soil in a lower portion of the purified water area 200, as shown in Fig. 1.
- [60] More preferably, an access port 42a closed with a cover 43 may be installed in the strainer 42. The access port 42a may be realized by cutting a part of the strainer 42 to mount and dismount the strainer 42, and workers may enter into the filter case 41 after they remove off the cover 43 and the access port 42a if apparatuses installed inside the filter case 41 need repair or maintenance.
- [61] According to the present invention, at least one filter membrane 44, 45 is installed inside the filter case 41 so that it can filter contaminated water. Preferably, the filter membrane 44, 45 is installed aslant toward a flow direction of water running from a lower portion to an upper portion, as shown in Fig. 5. More preferably, the filter membrane 44, 45 may have a form of an erect cone with sloping sides. If the filter membranes are inclined aslant, they may be prevented from being closed since their filtration surface area may be increased, as well as the pollutants may be easily detached from the filter membranes.
- [62] The filter membranes 44, 45 may be arranged by combining a plurality of meshes having minute pores. Filtration may sequentially arise in each layer by preferably stacking meshes having different mesh numbers in every layer, more preferably

meshes whose numbers can gradually increase from lower portions to upper portions of the filter membranes 44, 45. Usually, the filter membranes 44, 45 may be made up of stainless steel, synthetic resins or fibers. However, configurations and materials of the filter membranes are not limited to the above, and conventional filter membranes made of various materials may be used for filtering water.

- [63] The filter membranes 44, 45 are installed so that their upper spaces and their lower spaces can be separated from each other, and, in an inner circumferential surface of the filter case 41, ring-shaped support brackets 46, to which outer circumferential ends of the filter membranes 44, 45 may be fixed, are preferably installed.
- [64] According to the configuration as described above, a plurality of concentration zones are formed in lower portions of the filter membranes 44, 45, and between the filter membranes 44, 45. In the embodiment as shown in Fig. 5, a first concentration zone (S1) is formed beneath the first filter membrane 44, a second concentration zone (S2) is formed between the first filter membrane 44 and the second filter membrane 45, and a purification zone (S3) is formed in an upper portion of the top filter membrane 45. Preferably, the filter membranes 44, 45 are arranged so that an upper filter membrane can have the minuter pores than a lower filter membrane. Accordingly, when the contaminated water is sequentially filtered through the filter membranes, the lower concentration zone contains the larger sludges or pollutants, and the water where the pollutants are filtered off flows upward through the purification zone (S3) into the purified water area 200.
- [65] According to the present invention, in an upper portion of the filter membranes 44, 45 are mounted injection units for detaching the sludges or pollutants attached in lower surfaces of the filter membranes downward.
- [66] The injection units include a plurality of injection pipes 50 rotationally installed in upper portions of the filter membranes 44, 45 to eject water.
- [67] The injection pipes 50 are supplied with water by a driving force of a second pump 60.
- [68] The second pump 60 is connected with an intake piping 24 for sucking the filtered water, present in the purification zone (S3), through an inlet 24a inside the filter case 41, and also connected with an injection piping 26 for supplying the introduced water into the filter case 41 again, as shown in Fig. 1. The injection piping 26 is extended from the second pump 60 to upper portions of the filter membranes 44, 45.
- [69] Referring to Figs. 6 and 7 showing detailed configurations of the injection pipe 50, a plurality of the injection pipes 50 whose ends are communicated with the injection piping 26 are supplied with water from the injection piping 26, and rotationally connected to the injection piping 26 in the center of the coupling unit.
- [70] The injection pipe 50 is preferably installed aslant along its shape to be adjacent to

upper surfaces of the filter membranes 44, 45. Also, a plurality of nozzles 50a for ejecting water toward the filter membranes 44, 45 are formed in the injection pipes 50, wherein the nozzles 50a are formed toward the filter membranes 44, 45 at an aslant angle, preferably at 45°, indicating that the injection pipes 50 are rotated by reaction generated when water is ejected through the nozzles 50a, as described later. Inclined angles of the nozzles may be suitably selected so that the injection pipes can be rotated by reaction to ejection, considering their efficiency. Also, the nozzles 50a may be formed into conventional through holes, or have a form of nozzle.

[71] As described above, the injection pipes 50 are rotationally coupled to the injection piping 26 in the center of a coupling unit, which is accomplished using a rotary connection unit 70 as shown in Fig. 7.

[72] The injection pipes 50 may be integrally formed, or integrally coupled by a coupling member 51. In this case, the coupling member 51 may be rotationally coupled with the injection piping 26.

[73] The rotary connection unit 70 includes a bush 71 coupled to be communicated with an end of the injection piping 26; and a rotary tube 72 rotationally coupled in the bush 71 and coupled to be communicated with an end of the injection pipe 50 or the coupling member 51.

[74] At an end of the rotary tube 72, a bracket 73 is formed, which is coupled with a bracket 75 formed at an end of the coupling member 51 using a coupling member such as a bolt 74. At an end of the bush 71, a bracket 76 is also formed, which may be coupled with a bracket 78 formed at an end of the injection piping 26 using a bolt 77.

[75] Bearings 79a, 79b are interposed between the bush 71 and the rotary tube 72 to facilitate their smooth rotation.

[76] More preferably, the rotary connection unit may be easily exchanged according to damage of the bearings and expiration of a service life since the intake member and the intake piping may be assembled or disassembled as one of parts.

[77] It should be understood that, although the coupling between the injection pipe 50 and the injection piping 26 has been described in detail in this embodiment, the present invention is not limited thereto, and any conventional configurations may be applied if the injection pipe may be arranged to be rotationally coupled with an intake piping.

[78] The size and number of the injection pipe 50 are not limited to the above, and may be suitably selected according to size, number and filtering capacity of the filter membrane.

[79] Meanwhile, pollutants concentrated in the inside of the filter case 41 are discharged through a transfer piping 22 connected to an end of the filter case 41, wherein the transfer piping 22 is connected with a main drain pipe 27 connected with the first pump 30. Accordingly, the pollutants sucked through the transfer piping 22 by a

driving force of the first pump 30 flow through the main drain pipe 27, and then are discharged through an outer discharge pipe 28 to the outside.

- [80] According to the present invention, the water filtering apparatus also includes an auxiliary drain pipe 29 for discharging the pollutants, concentrated in the concentration zone (S2) between the filter membranes 44, 45, to the outside. The auxiliary drain pipe 29 is connected between the concentration zone (S2), formed between the filter membranes 44, 45, and the main drain pipe 27 to discharge pollutants using a driving force of the first pump 30. Preferably, the auxiliary drain pipe 29 is extended right above to a lower end of a first filter membrane 44.
- [81] More preferably, drain rings 52 installed along a lower edge of the filter membrane are provided in the concentration zone (S2). The drain rings 52 are pipes connected with the auxiliary drain pipe 29, and have a plurality of drain holes (Not shown) formed therein. Accordingly, the contaminated water in the concentration zone (S2) may be discharged through the drain holes. The pollutants, deposited or sliding down along upper surfaces of the filter membranes, may be effectively discharged from a wide region by installing the drain rings 52 along a lower circumferential edge of the filter membrane.
- [82] A configuration of the illustrated drain pipe is just an example for simply constructing a piping, but the present invention is not limited thereto, and the drain pipe may be arranged as a different path from an intake piping and a transfer piping.
- [83] Preferably, draining timing may be determined by a concentration sensor 53 provided in at least one of the concentration zones (S1, S2) by measuring a concentration of the pollutants in water.
- [84] The water filtering apparatus of the present invention may be installed right beneath the purified water area 200, as shown in Fig. 1. In this case, various aquatic plants of the purified water area 200 may be created on the water filtering apparatus to maintain natural landscapes intact.
- [85] In Fig. 1, reference numerals 81, 82, 83, 84, 85 indicate valves, respectively. Such valves select a flow path of water for filtration and a flow path of water for discharging pollutants by selectively opening or closing each pipe channel.
- [86] Although pipings between an intake unit and a pump, and between an intake unit and the water filtering apparatus have been described in detail in this specification and illustrated in the accompanying drawing, the pipings between them may be modified and exchanged without departing from the spirit and scope of the invention. For example, a plurality of pumps may be also used for various usages, respectively.
- [87] Hereinafter, an operation of a system for filtering water for purification according to the present invention configured as mentioned above will be described in detail, as follows.

- [88] For operating the water filtering system of the present invention, the first pump 30 is firstly driven to suck sludges together with water in the lower water area 100 through the intake piping 20. At this time, the valves 81, 83 remain opened, and the valves 82, 84, 85 remain closed.
- [89] A suction force by the pump 30 is transmitted to the intake members 11, 11' communicated with the intake piping 20, and therefore water and sludges are sucked through the first and second intake holes 12a, 12b of the intake members 11, 11'. At this time, the intake members 11, 11' are rotated as illustrated in Fig. 3, for example counterclockwise by reaction generated when the water and the sludges are sucked since the first and second intake holes 12a, 12b are formed all in one direction. The size and length of the intake members 11, 11' are preferably suitably selected considering a rotation force by the reaction as described above.
- [90] Such a rotation of the intake members 11, 11' prevents sludges from being deposited, and simultaneously is forced to effectively suck more sludges from a wider region since they effectively suck the deposited sludges without floating the deposited sludges around the collection orifice 110.
- [91] A mixing water of sludges sucked through the intake piping 20 into the inflow port 31 of the first pump 30 is discharged into an outlet 32 of the first pump 30, and then flows through the transfer piping 22 into the filter case 41 of the water filtering apparatus 40.
- [92] Then, the mixing water of sludges sucked through the inflow port 22a in the lower end of the filter case 41 is filtered through the first filter membrane 44. At this time, the filtered sludge pollutants are attached onto a lower surface of the first filter membrane 44, and the water flows through the first filter membrane 44 into a second filter membrane 45. Preferably, relatively larger pollutant particles are filtered through the first filter membrane 44.
- [93] Next, smaller pollutants are filtered in the same manner as described above while the mixing water of sludges flows upward through the second filter membrane 45.
- [94] The clean water, purified through a plurality of the filter membranes in the same manner as described above, is collected in the purification zone (S3) and ejected through pebbles and a sand layer on the filter membranes into the purified water area 200, and then flows along the stepped water area 300 into the lower water area 100. Although this embodiment shows that the water filtering apparatus is buried right beneath the purified water area 200, the filtered water separated by the water filtering apparatus may flow into the purified water area 200 via a separate path as another alternative.
- [95] According to the present invention, the filter membranes are washed by operating an injection unit and simultaneously filtering water for purification in the same manner

as described above.

[96] Specifically, some of the water collected in the purification zone (S3) through a plurality of the filter membranes 44, 45 is sucked through an inlet 24a into the intake piping 24, and then supplied through the injection piping 26 into the filter case 41 using a driving force of the second pump 60.

[97] The water supplied through the injection piping 26 flows into the injection pipe 50 rotationally connected to an end thereof, and then is ejected through nozzles 50a. At this time, the nozzles 50a are inclined aslant toward the filter membranes 44, 45, and therefore the water ejected from the nozzles 50a collides with the filter membranes 44, 45. Accordingly, the sludge pollutants, attached onto the lower surfaces of the filter membranes 44, 45, are detached by the ejected water, and then slide downward, as described above.

[98] In addition, the nozzles 50a are formed aslant in one direction (i.e., a counter-clockwise direction) toward a side of the injection pipe 50, and therefore the injection pipes 50 are rotated as described in Fig. 6, for example clockwise by reaction to injection pressure of the water. As a result, the injection pipes 50 eject water while they are rotated adjacent to upper surfaces of the filter membranes 44, 45, and therefore the sludges attached onto the lower surfaces of the filter membranes may be detached therefrom.

[99] If a process for filtering a mixing water of sludges proceeds in this manner, an additional amount of pollutants are accumulated and concentrated in the concentration zones (S1, S2). If the second filter membrane 45 filters smaller particles than the first filter membrane 44, a concentration of pollutants in the first concentration zone (S1) will be higher than that of pollutants in the second concentration zone (S2).

[100] If the concentration of the pollutants increases in the concentration zones (S1, S2), this condition may be preferably measured by a concentration sensor, and then informed to workers. If the concentration of the pollutants exceeds a predetermined reference value, water is drained manually or automatically. As an alternative, the concentration sensor may be exchanged with a pressure sensor. If the concentration of the pollutants increases and some of the filter membranes are closed, a filtration head (a hydraulic pressure) increases in the concentration zones, and then the pressure sensor may sense such a pressure change to transmit signals to a control unit (Not shown). In the present invention, it should be understood that the sensors, including the concentration sensor and the pressure sensor, are referred to as a unit for sensing physical changes generated when a concentration of the pollutants increases in the concentration zones.

[101] For the operation of draining water, the valves 82, 84, 85 are opened and the valves 81, 83 are closed.

- [102] In such a state, if the first pump 30 is driven, water flows backward to drain water in the filter case 41 through the transfer piping 22 and the main drain pipe 27. As a result, the pollutants accumulated in the first concentration zone (S1) are discharged through the transfer piping 22, and the pollutants accumulated in the second concentration zone (S2) between the filter membranes flow through drain holes of the drain ring 52, and then discharged through an auxiliary drain pipe 29 into the main drain pipe 27. At this time, since the injection unit continues to be driven for a predetermined time, some of pollutants attached onto the lower surfaces of the filter membranes 44, 45 are also detached by the ejected water, resulting in accelerated drainage.
- [103] Subsequently, the drained pollutants are completely discharged through an outer discharge pipe 28 to the outside.
- [104] Fig. 8 shows a system for filtering water for purification using an upflow filtration method having a rotary multi-layer structure according to another preferred embodiment of the present invention. Here, the same reference numerals as in the above drawing represent the same members.
- [105] The water filtering system of this embodiment includes a plurality of sludge intake apparatuses 10 installed inside the lower water area 100. A configuration of the sludge intake apparatuses 10 is omitted since it is the same as described above.
- [106] The mixing water of sludges flowing into a first pump 130 along the intake piping 20 flows into a water filtering apparatus 140 along a transfer piping 122 connected to the first pump 130. The water filtering apparatus 140 of this embodiment may be independently mounted in separate locations such as an apparatus room instead of being installed beneath the ground.
- [107] Referring to Fig. 9 showing a detailed configuration of the water filtering apparatus 140, the water filtering apparatus includes a closed housing 141, and a plurality of filter membranes 144, 145 installed inside the housing 141.
- [108] In a bottom of the housing 141, an inflow port 142 is formed, to which an end of a transfer piping 122 connected with the first pump 130 is connected. At an upper end of the housing 141, an outlet 143 is also formed, to which a circulation piping 124 is connected to supply the filtered water into the purified water area 200 through the circulation piping 124.
- [109] At least one access port 147 is also formed inside the housing 141, and workers may enter the housing 141 through the access port 147 if apparatuses installed inside the housing 141 need maintenance or repair.
- [110] In the embodiment as described above, filter membranes 144, 145 are installed aslant toward a flow direction of water running from a lower portion to an upper portion in the inside of the housing 141, and more preferably may have a form of an

erect cone with sloping sides. A configuration of the filter membrane 144, 145 is omitted since it is the same as described above.

- [111] The filter membranes 144, 145 are installed so that an upper space and a lower space can be separated from each other in the inside thereof, and, in an inner circumferential surface of the housing 141, ring-shaped support brackets 146, to which lower circumferential portions of the filter membranes 144, 145 may be fixed, are preferably installed.
- [112] According to such a configuration, a plurality of concentration zones are formed in lower portions of the filter membranes 144, 145, and between the filter membranes 144, 145. That is, a first concentration zone (S1) is formed beneath a first filter membrane 144, a second concentration zone (S2) is formed between the first filter membrane 144 and a second filter membrane 145, and a purification zone (S3) is formed in an upper portion of the top filter membrane 145. Preferably, the filter membranes 44, 45 are arranged so that an upper filter membrane can have the minuter pores than a lower filter membrane. Accordingly, when the contaminated water is sequentially filtered through the filter membranes, the lower concentration zone contains larger sludges or pollutants, and the water where the pollutants are filtered off flows upward through the purification zone (S3) into the purified water area 200.
- [113] According to the present invention, in an upper portion of the filter membranes 144, 145, injection units for detaching the sludges or pollutants attached in lower surfaces of the filter membranes downward are mounted.
- [114] The injection units include a plurality of injection pipes 150 rotationally installed in upper portions of the filter membranes 144, 145 to eject water, and a second pump 160 for supplying water into the injection pipe 150.
- [115] As described in Fig. 9, the second pump 160 is installed on an injection piping 126 arranged to be connected between the circulation piping 124 and the housing 141, and therefore the second pump 160 sucks some of the water flowing through the circulation piping 124 to supply the introduced water into the housing 141.
- [116] The injection pipes 150 whose ends are communicated with the injection piping 126 are supplied with water from the injection piping 126, and rotationally connected to the injection piping 126 in the center of the coupling unit using a rotary connection unit 170. Configurations of the injection pipe 150 and the rotary connection unit 170 are not described here in detail since they are the same as in the above embodiment.
- [117] Pollutants concentrated in the inside of the housing 141 are discharged through the transfer piping 122 connected to a lower end of the housing 141, wherein the transfer piping 122 is connected with the main drain pipe 127 connected with the first pump 130. Accordingly, the pollutants sucked through the transfer piping 122 by a driving force of the first pump 130 flow along the main drain pipe 127, and then are

discharged through an outer discharge pipe 128 to the outside.

[118] Also, the concentration zone (S2) between the filter membranes 144, 145 is provided with an auxiliary drain pipe 129 for discharging the concentrated pollutants to the outside. The auxiliary drain pipe 129 is connected between the concentration zone (S2), formed between the filter membranes 144, 145, and the main drain pipe 127 to discharge pollutants using a driving force of the first pump 130.

[119] More preferably, the concentration zone (S2) is provided with drain rings 152 installed along an edge of an outer circumferential end of the filter membrane. The drain rings 152 are pipes connected with the auxiliary drain pipe 129, and have a plurality of drain holes (Not shown) formed therein. Accordingly, the contaminated water in the concentration zone (S2) may be discharged through the drain holes. The pollutants, deposited or sliding down along upper surfaces of the filter membranes, may be effectively discharged from a wide region by installing the drain rings 152 with a ring shape along an edge of an outer circumferential end of the filter membrane.

[120] Also, draining timing may be determined by a concentration sensor 153 provided in at least one of the concentration zones (S1, S2) by measuring a concentration of the pollutants in water.

[121] In Fig. 8, the reference numerals 181, 182, 183, 184, 185, 186 indicate valves, respectively. Although pipings between the intake unit and the pump, and between the intake unit and the water filtering apparatus have been described in detail in this specification and the accompanying drawing, the pipings between them may be modified and changed without departing from the spirit and scope of the invention. For example, a plurality of pumps may be also used for separate applications.

[122] For operating water filtering apparatus according to this embodiment, the first pump 130 is firstly driven to suck sludges and pollutants together with water through the intake apparatus 10 and the intake piping 20 from the lower water area 100. At this time, the valves 181, 183, 186 remain opened, and the valves 182, 184, 185 remain closed.

[123] The mixing water of sludges sucked through the intake piping 20 flows through the transfer piping 122 into the filter case 141 of the water filtering apparatus 140.

[124] Then, the mixing water of sludges sucked through the inflow port 142 at a lower end of the housing 141 is filtered through the first filter membrane 144. At this time, the filtered sludge pollutants are attached onto a lower surface of the first filter membrane 144, and water flows through the first filter membrane 144 into the second filter membrane 145. Preferably, relatively large pollutant particles are filtered through the first filter membrane 144.

[125] Next, smaller pollutant particles are filtered in the same manner as described above while the mixing water of sludges flows upward through the second filter membrane

145.

[126] Clean water, purified through a plurality of the filter membranes in the same manner as described above, is collected into the purification zone (S3), passed through an outlet 143 of an upper portion of the housing 141, and then supplied through the circulation piping 124 into the purified water area 200.

[127] According to the present invention, filter membranes are washed by operating the injection unit together with filtering water for purification in this manner.

[128] Specifically, some of the water, filtered through a plurality of the filter membranes 144, 145 and supplied through the circulation piping 124, is supplied through the injection piping 126 into the filter case 141 using a driving force of the second pump 160.

[129] Subsequently, the water supplied through the injection piping 126 flows into the injection pipe 150 rotationally connected to an end thereof, and then is ejected through nozzles 150a. At this time, the nozzles 150a are inclined aslant toward the filter membranes 144, 145, and therefore the water ejected from the nozzles 150a collides with the filter membranes 144, 145. Accordingly, the sludge pollutants, attached onto the lower surfaces of the filter membrane 144, 145, are detached by the ejected water, and then slide downward, as described above.

[130] In addition, the nozzles 150a are formed aslant in one direction (i.e., a counter-clockwise direction) toward a side of the injection pipe 150, and therefore the injection pipes 150 are rotated as shown in Fig. 6, for example rotated clockwise by reaction to an injection pressure of the water. Accordingly, the injection pipes 150 eject water while they rotate adjacent to upper surfaces of the filter membranes 144, 145, and therefore the sludges attached onto the lower surfaces of the filter membranes may be detached therefrom.

[131] If a process for filtering a mixing water of sludges continue to be carried out in this manner, an additional amount of pollutants are accumulated and concentrated in the concentration zones (S1, S2). If the concentration of the pollutants increases in the concentration zones (S1, S2), this condition may be preferably measured by the concentration sensor, and then informed to workers. If a concentration of the pollutants exceeds a predetermined reference value, water is drained manually or automatically.

[132] For the water draining work, the valves 182, 184, 185 are opened and the valves 181, 183, 186 are closed.

[133] In such a state, if the first pump 130 is driven, water flows backward to drain water through the transfer piping 122 and the main drain pipe 127 from the housing 141. As a result, the pollutants accumulated in the first concentration zone (S1) are discharged through the transfer piping 122, and the pollutants accumulated in the second concentration zone (S2) between the filter membranes flow through drain holes of the

drain ring 152, and then discharged through the auxiliary drain pipe 129 into the main drain pipe 127. At this time, since the injection unit continues to be driven for a predetermined time, some of pollutants attached onto the lower surfaces of the filter membranes 144, 145 are also detached by the ejected water, resulting in accelerated drainage.

[134] Subsequently, the drained pollutants are completely discharged through the outer discharge pipe 128 to the outside.

[135] According to another embodiment of the present invention, the filter membranes may be arranged in an inverted direction. Figs. 10 and 11 show an apparatus for filtering water for purification having such an inverted configuration. In Figs. 10 and 11, the same reference numerals represent the same members having the same functions as described in fig. 9.

[136] Referring to Fig. 10, the water filtering apparatus of this embodiment includes a filter case 41 composed of a cylindrical body unit 41a and a hopper-type concentration unit 41b.

[137] In the filter case 41, at least one filter membrane 244, 245 is installed aslant toward a flow direction of water to filter the contaminated water, and the filter membranes 244, 245 preferably have a form of an inverted cone with sloping sides.

[138] The filter membranes 244, 245 are installed so that upper and lower spaces of the filter membranes 244, 245 can be separated from each other, and ring-shaped support brackets 246, to which outer circumferential ends of the filter membranes 244, 245 may be fixed, are preferably installed on an inner circumferential surface of the filter case 41.

[139] According to the configuration as described above, a plurality of concentration zones are formed in lower portions of the filter membranes 244, 245, and between the filter membranes 244, 245. That is to say, a first concentration zone (S1) is formed beneath the first filter membrane 244, a second concentration zone (S2) is formed between the first filter membrane 244 and the second filter membrane 245, and a purification zone (S3) is formed in an upper portion of the top filter membrane 245. Preferably, the filter membranes 244, 245 are arranged so that an upper filter membrane can have the minuter pores than a lower filter membrane.

[140] In an upper portion of the filter membranes 244, 245, injection units for detaching the sludges or pollutants attached on surfaces of the filter membrane downward are mounted, wherein the injection units include a plurality of injection pipes 250 rotationally installed in upper portions of the filter membranes 244, 245 to eject water. The injection pipes 250 are supplied with water by a driving force of the second pump 60 (see Fig. 1).

[141] The second pump 60 is connected with an intake piping 24' for sucking the filtered

water, present in the purification zone (S3) inside the filter case 41, and with an injection piping 26' for supplying the introduced water into the filter case 41 again. Preferably, an end of the intake piping 24' is extended right above to a central region of the inverted filter membrane 244 to suck the filtered water. The injection piping 26' is also extended from the second pump 60 to upper portions of the filter membranes 244, 245 inside the filter case 41.

[142] A plurality of the injection pipes 250 whose ends are communicated with the injection piping 26' are supplied with water from the injection piping 26', and rotationally connected to the injection piping 26' in the center of the coupling unit.

[143] The injection pipe 250 is preferably installed aslant along a shape thereof to be adjacent to the upper surfaces of the filter membranes 244, 245. Also, a plurality of nozzles 250a for ejecting water toward the filter membranes 244, 245 are formed in the injection pipes 250, wherein the nozzles 250a are formed toward the filter membranes 244, 245 at an aslant angle, preferably at 45°.

[144] The injection pipes 250 are rotationally coupled to the injection piping 26' in the center of a coupling unit using a rotary connection unit 70, and a configuration of the rotary connection unit 70 is omitted since it is the same as in the embodiment described above.

[145] The pollutants concentrated inside the filter case 41 are discharged through the transfer piping 22 connected to a lower end thereof, wherein the transfer piping 22 is connected with the main drain pipe 27 connected with the first pump 30. Accordingly, the pollutants sucked through the transfer piping 22 by a driving force of the first pump 30 flow along the main drain pipe 27, and then are discharged through the outer discharge pipe 28 to the outside.

[146] According to this embodiment, the concentration zone (S2) between the filter membranes 244, 245 is also provided with an auxiliary drain pipe 229 for discharging the concentrated pollutants to the outside. The auxiliary drain pipe 229 is connected between the concentration zone (S2), formed between the filter membranes 244, 245, and the main drain pipe 27 to discharge pollutants using a driving force of the first pump 30.

[147] Preferably, a discharge hole 229a is apically formed in a central region of the lowest filter membrane 244 having a form of an inverted cone, and an end of the auxiliary drain pipe 229 is connected to the discharge hole 229a. Accordingly, the contaminated water in the concentration zone (S2) may be discharged through the discharge hole 229a. The pollutants, which precipitate or slide down along an upper surface of the filter membrane, may be effectively removed off by apically forming the discharge hole 229a in a central region of the filter membrane.

[148] Also, draining timing may be preferably determined by a concentration sensor 53

provided in at least one of the concentration zones (S1, S2) by measuring a concentration of the pollutants in water.

[149] Operation of the water filtering apparatus of this embodiment is not described in detail since the operation is the same as described above, except that pollutants of the concentration zone (S2) flow through the discharge hole 229a apically formed in a central region of the inverted filter membrane 244, and then are discharged along the auxiliary drain pipe 229.

[150] Fig. 11 shows a configuration of an apparatus for filtering water for purification according to another preferred embodiment of the present invention. In Fig. 11, the same reference numerals represent the same members having the same functions as described in the previous drawings.

[151] The water filtering apparatus includes a closed housing 141, and a plurality of filter membranes 344, 345 installed in the inside of the housing 141.

[152] In the bottom of the housing 141, an inflow port 142 is formed, to which an end of a transfer piping 122 connected with the first pump 130 (see Fig. 8) is connected. At an upper end of the housing 141, an outlet 143 is also formed, to which the circulation piping 124 is connected to supply the filtered water through the circulation piping 124 into the purified water area 200.

[153] At the housing 141, at least one access port 147' is also formed, through which workers may enter the housing 141 if apparatuses installed inside the housing 141 need maintenance or repair.

[154] In the embodiments as described above, the filter membranes 344, 345 are installed aslant toward a flow direction of water running from a lower portion to an upper portion in the housing 141, and the filter membranes 344, 345 more preferably may have a form of an inverted cone with sloping sides.

[155] The filter membranes 344, 345 are installed so that their upper spaces and their lower spaces can be separated from each other, and, in an inner circumferential surface of the filter case 141, ring-shaped support brackets 346, to which outer circumferential ends of the filter membranes 344, 345 may be fixed, are preferably installed.

[156] According to the configuration as described above, a plurality of concentration zones are formed in lower portions of the filter membranes 344, 345, and between the filter membranes 344, 345. That is to say, a first concentration zone (S1) is formed beneath the first filter membrane 344, a second concentration zone (S2) is formed between the first filter membrane 344 and the second filter membrane 345, and a purification zone (S3) is formed in an upper portion of the top filter membrane 345.

[157] At an upper portion of the filter membranes 344, 345, injection units for detaching the sludges or pollutants attached on surfaces of the filter membranes downward are mounted.

- [158] The injection units include a plurality of injection pipes 350 rotationally installed in upper portions of the filter membranes 344, 345 to eject water.
- [159] The second pump 160 is installed on an injection piping 126 which connects the circulation piping 124 with the housing 141 to suck some of the water flowing along the circulation piping 124, and then supply the water into the housing 141.
- [160] The injection pipes 350 whose ends are communicated with the injection piping 126 are supplied with water from the injection piping 126, and rotationally connected to the injection piping 126 in the center of the coupling unit using the rotary connection unit 170. Configurations of the injection pipe 350 and the rotary connection unit 170 are not described here in detail since they are the same as in the above embodiment.
- [161] Pollutants concentrated in the inside of the housing 141 are discharged through the transfer piping 122 connected to the lower end of the housing 141, wherein the transfer piping 122 is connected with the main drain pipe 127 connected with the first pump 130. Accordingly, the pollutants sucked through the transfer piping 122 flow along the main drain pipe 127, and then are discharged through the outer discharge pipe 128 to an outside using a driving force of the first pump 130.
- [162] Also, the concentration zone (S2) between the filter membranes 344, 345 is provided with an auxiliary drain pipe 329 for discharging the concentrated pollutants to an outside. The auxiliary drain pipe 329 is connected between the concentration zone (S2), formed between the filter membranes 344, 345, and the main drain pipe 127 to discharge pollutants using a driving force of the first pump 130.
- [163] Preferably, a discharge hole 329a is apically formed in a central region of the lowest filter membrane 344 having a form of an inverted cone, and an end of the auxiliary drain pipe 329 is connected to the discharge hole 329a. Accordingly, the contaminated water in the concentration zone (S2) may be discharged through the discharge hole 329a. The pollutants, which precipitate or slide down along an upper surface of the filter membrane, may be effectively removed off by apically forming the discharge hole 329a in a central region of the filter membrane.
- [164] Operation of the apparatus for filtering water for purification according to this embodiment is not described here in detail since the operation is the same as described above, except that pollutants of the concentration zone (S2) flow through the discharge hole 329a apically formed in a central region of the inverted filter membrane 344, and then are discharged along the auxiliary drain pipe 329.

Industrial Applicability

- [165] The system for filtering water for purification according to the present invention has advantages, as follows.
- [166] First, sludges may be prevented from being deposited or precipitated, and also ef-

fectively removed from a broader area since water and sludges are sucked by rotation of an intake member.

[167] Second, additional driving units such as a motor need not to be mounted, and therefore the system may be simple in its structure and installing and manufacturing costs may be reduced because the intake member is rotated by reaction to a suction force without any driving source.

[168] Third, an environment-friendly system may be accomplished without any damage of water landscapes and water environments by installing an intake member to be covered up in pebbles, etc.

[169] Fourth, according to the water filtering system of the present invention, the filtered water may be steadily obtained, and simultaneously the water of a purified water area may be prevented from being contaminated, and water landscapes from being damaged since sludges are separated from water using an upflow filtration method having a rotary multi-layer structure.

[170] Fifth, filter membranes may be prevented from being closed with time, and therefore their efficiency may be improved since the filter membranes with gradually minuter pores are sequentially installed and the sludges and pollutants are detached together with filtering water using an injection unit. First of all, operation of the apparatus does need not be suspended for washing the filter membranes since the filter membranes are washed at the same time as filtering water.

[171] Sixth, pollutants may be completely removed by flowing a small amount of water backward upon draining water if they are mainly concentrated in a lower portion of a filter membrane in the water filtering apparatus of the present invention.

Claims

- [1] An apparatus for filtering water for purification, comprising:
a filter case having an inflow port formed in a lower end thereof and whose upper side is open;
at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the filter case to an upper portion of the filter case so that an upper space and a lower space of the filter case are separated inside the filter case; and
an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane,
wherein the water containing the pollutants flows through the inflow port into the filter case, and then is filtered through the filter membrane and discharged through the open upper side during a filtering operation, and
wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.
- [2] The apparatus for filtering water for purification according to claim 1, further comprising an auxiliary drain pipe for draining the pollutants accumulated in a concentration zone (S2) between the filter membranes.
- [3] The apparatus for filtering water for purification according to claim 2, wherein the filter membrane has a form of an erect cone.
- [4] The apparatus for filtering water for purification according to claim 3, further comprising drain rings installed along an edge of an outer circumferential end of the filter membranes to be communicated with the auxiliary drain pipe and having a plurality of drain holes formed for draining pollutants of the concentration zone (S2).
- [5] The apparatus for filtering water for purification according to claim 2, wherein the filter membrane has a form of an inverted cone.
- [6] The apparatus for filtering water for purification according to claim 5, wherein a discharge hole is apically formed in a central region of the lowest filter membrane, and an end of the auxiliary drain pipe is connected to the discharge hole.
- [7] The apparatus for filtering water for purification according to claim 1, wherein the injection unit includes a plurality of injection pipes rotationally installed in an upper portion of the filter membrane and having a plurality of nozzles formed for ejecting water toward the filter membrane,

wherein the nozzles are formed to be inclined aslant in one direction toward the filter membrane.

- [8] The apparatus for filtering water for purification according to claim 7, wherein the injection unit includes:
an intake piping connected to the filter case to suck water of a purification zone (S3) filtered through the filter membrane;
an injection piping extended to an upper portion of a filter membrane in the inside of the filter case;
a pump for applying a driving force so that the water sucked through the intake piping flows into the injection piping; and
a rotary connection unit for rotationally coupling the injection pipe with an end of the injection piping.

- [9] An apparatus for filtering water for purification, comprising:
a closed housing having an inflow port formed in a lower end thereof and an outlet formed in an upper surface thereof;
at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the housing to an upper portion of the housing so that an upper space and a lower space of the housing are separated inside the housing; and
an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane,
wherein the water containing the pollutants flows through the inflow port into the housing to be filtered through the filter membrane, and then discharged through the outlet during a filtering operation, and
wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.

- [10] The apparatus for filtering water for purification according to claim 9, further comprising an auxiliary drain pipe for draining the pollutants accumulated in a concentration zone (S2) between the filter membranes.

- [11] The apparatus for filtering water for purification according to claim 10, wherein the filter membrane has a form of an erect cone.

- [12] The apparatus for filtering water for purification according to claim 11, further comprising drain rings installed along an edge of an outer circumferential end of the filter membranes to be communicated with the auxiliary drain pipe and having a plurality of drain holes formed for draining pollutants of the concentration zone (S2).

- [13] The apparatus for filtering water for purification according to claim 10, wherein the filter membrane has a form of an inverted cone.
- [14] The apparatus for filtering water for purification according to claim 13, wherein a discharge hole is apically formed in a central region of the lowest filter membrane, and an end of the auxiliary drain pipe is connected to the discharge hole.
- [15] The apparatus for filtering water for purification according to claim 9, wherein the injection unit includes a plurality of injection pipes rotationally installed in an upper portion of the filter membrane and having a plurality of nozzles formed for ejecting water toward the filter membrane, wherein the nozzles are formed to be inclined aslant in one direction toward the filter membrane.
- [16] The apparatus for filtering water for purification according to claim 15, wherein the injection unit includes:
an injection piping extended from a circulation piping to an upper portion of a filter membrane in the inside of the housing, wherein the circulation piping supplies the filtered water drained into the outlet to a purified water area;
a pump for applying a driving force so that some of the filtered water flowing along the circulation piping flows into the injection piping; and
a rotary connection unit for rotationally coupling the injection pipe with an end of the injection piping.
- [17] A system for filtering water for purification, comprising:
a first pump;
an intake piping for sucking sludges along with water from a lower water area using a driving force of the first pump;
a plurality of intake members whose ends are coupled to be communicated with the intake piping and also rotationally installed in the center of the coupling unit in the inside of a collection orifice formed in a bottom of the lower water area, and having a plurality of intake holes formed for sucking water and sludges into the inside of the collection orifice;
a filter case having an inflow port formed for influxing the water and the sludges influxed through the intake piping in a lower end thereof and whose upper side is open;
at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the filter case to an upper portion of the filter case so that an upper space and a lower space of the filter case are separated inside the filter case; and
an injection unit for ejecting the water, filtered by the filter membrane, toward an

upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane,
wherein the water containing the pollutants flows through the inflow port into the filter case, and then is filtered through the filter membrane and discharged through the open upper side during a filtering operation, and
wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.

- [18] The system for filtering water for purification according to claim 17, wherein the intake members are hollow cylindrical pipes, and the intake holes are formed to be inclined aslant in one direction toward the intake member.
- [19] The system for filtering water for purification according to claim 18, further comprising:
a coupling member coupled with an end of the intake member and also rotationally coupled with the intake piping so that the intake member is communicated with the intake piping; and
a rotary connection unit interposed between the coupling member and the intake piping to be rotationally coupled with each other.
- [20] The system for filtering water for purification according to claim 17, further comprising an auxiliary drain pipe for draining the pollutants accumulated in a concentration zone (S2) between the filter membranes.
- [21] The system for filtering water for purification according to claim 20, wherein the filter membrane has a form of an erect cone.
- [22] The system for filtering water for purification according to claim 21, further comprising drain rings installed along an edge of an outer circumferential end of the filter membranes to be communicated with the auxiliary drain pipe and having a plurality of drain holes formed for draining pollutants of the concentration zone (S2).
- [23] The system for filtering water for purification according to claim 20, wherein the filter membrane has a form of an inverted cone.
- [24] The system for filtering water for purification according to claim 23, wherein a discharge hole is apically formed in a central region of the lowest filter membrane, and an end of the auxiliary drain pipe is connected to the discharge hole.
- [25] The system for filtering water for purification according to claim 17, wherein the injection unit includes a plurality of injection pipes rotationally installed in an upper portion of the filter membrane and having a plurality of nozzles formed for ejecting water toward the filter membrane,

wherein the nozzles are formed to be inclined aslant in one direction toward the filter membrane.

- [26] The system for filtering water for purification according to claim 25, wherein the injection unit includes:
an intake piping connected to the filter case to intake water of a purification zone (S3) filtered through the filter membrane;
an injection piping extended to an upper portion of a filter membrane in the inside of the filter case;
a second pump for applying a driving force so that water sucked through the intake piping flows into the injection piping; and
a rotary connection unit for rotationally coupling the injection pipe with an end of the injection piping.

- [27] A system for filtering water for purification, comprising:
a first pump;
an intake piping for sucking sludges along with water from a lower water area using a driving force of the first pump;
a plurality of intake members whose ends are coupled to be communicated with the intake piping and also rotationally installed in the center of the coupling unit in the inside of a collection orifice formed in a bottom of the lower water area, and having a plurality of intake holes formed for sucking water and sludges into the inside of the collection orifice;
a closed housing having an inflow port formed for influxing the water and the sludges influxed through the intake piping in a lower end thereof, and an outlet formed in an upper surface thereof;
at least one filter membrane installed aslant toward a flow direction of water running from a lower portion of the housing to an upper portion of the housing so that an upper space and a lower space of the housing are separated inside the housing; and
an injection unit for ejecting the water, filtered by the filter membrane, toward an upper surface of the filter membrane to detach pollutants attached to a lower surface of the filter membrane,
wherein the water containing the pollutants flows through the inflow port into the housing to be filtered through the filter membrane, and then discharged through the outlet during a filtering operation, and
wherein pollutants accumulated on the lower portion of the filter membrane are discharged through the inflow port to the outside during a pollutant discharging operation.

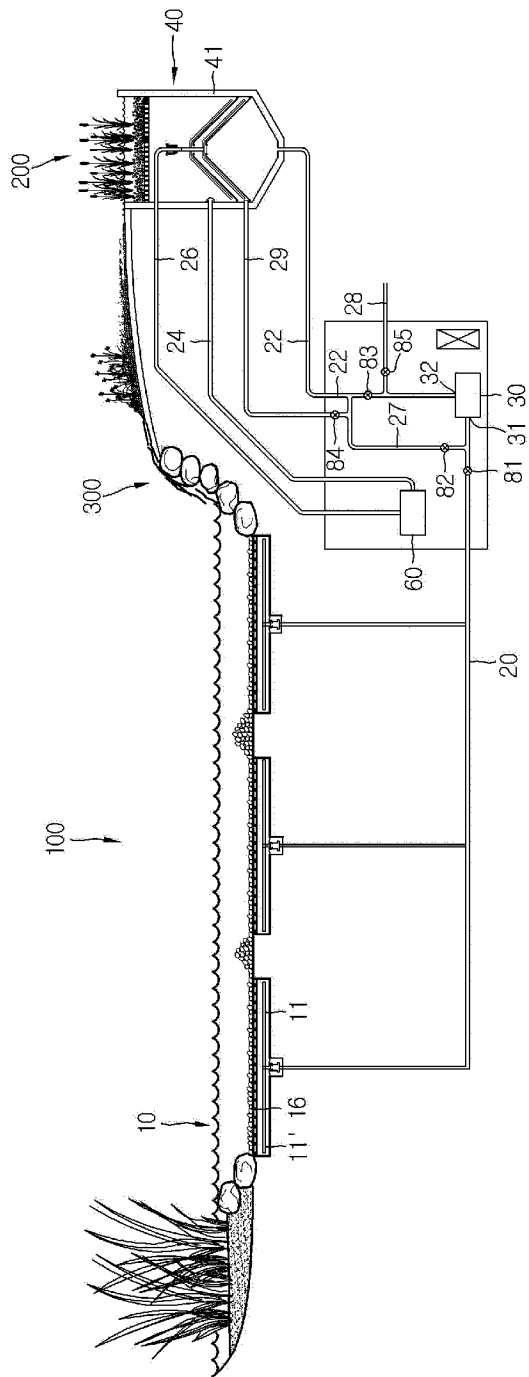
- [28] The system for filtering water for purification according to claim 27,

wherein the intake members are hollow cylindrical pipes, and the intake holes are formed to be inclined aslant in one direction toward the intake member.

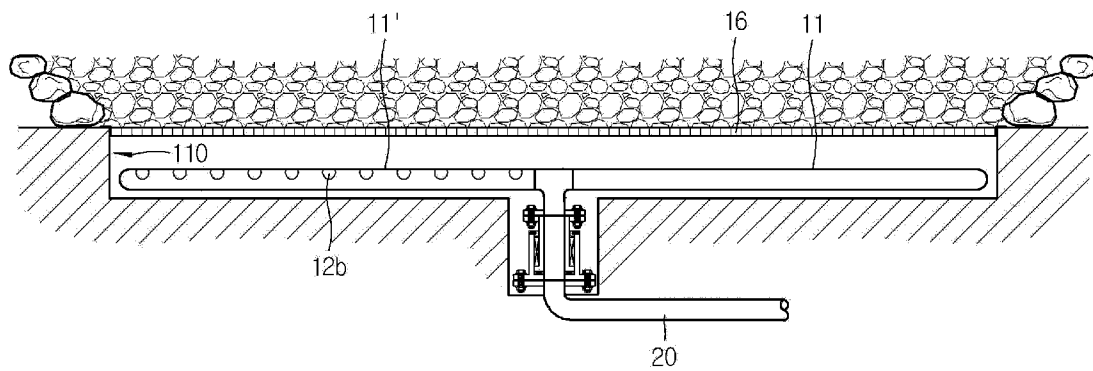
- [29] The system for filtering water for purification according to claim 28, comprising: a coupling member coupled with an end of the intake member and also rotationally coupled with the intake piping so that the intake member is communicated with the intake piping; and a rotary connection unit interposed between the coupling member and the intake piping to be rotationally coupled with each other.
- [30] The system for filtering water for purification according to claim 27, further comprising an auxiliary drain pipe for draining the pollutants accumulated in a concentration zone (S2) between the filter membranes.
- [31] The system for filtering water for purification according to claim 30, wherein the filter membrane has a form of an erect cone.
- [32] The system for filtering water for purification according to claim 31, further comprising drain rings installed along an edge of an outer circumferential end of the filter membranes to be communicated with the auxiliary drain pipe and having a plurality of drain holes formed for draining pollutants of the concentration zone (S2).
- [33] The system for filtering water for purification according to claim 30, wherein the filter membrane has a form of an inverted cone.
- [34] The system for filtering water for purification according to claim 33, wherein a discharge hole is apically formed in a central region of the lowest filter membrane, and an end of the auxiliary drain pipe is connected to the discharge hole.
- [35] The system for filtering water for purification according to claim 27, wherein the injection unit includes a plurality of injection pipes rotationally installed in an upper portion of the filter membrane and having a plurality of nozzles formed for ejecting water toward the filter membrane, wherein the nozzles are formed to be inclined aslant in one direction toward the filter membrane.
- [36] The system for filtering water for purification according to claim 35, wherein the injection unit includes: an injection piping extended from a circulation piping to an upper portion of a filter membrane in the inside of the housing, wherein the circulation piping supplies the filtered water drained into the outlet to a purified water area; a second pump for applying a driving force so that some of the filtered water flowing along the circulation piping flows into the injection piping; and a rotary connection unit for rotationally coupling the injection pipe with an end

of the injection piping.

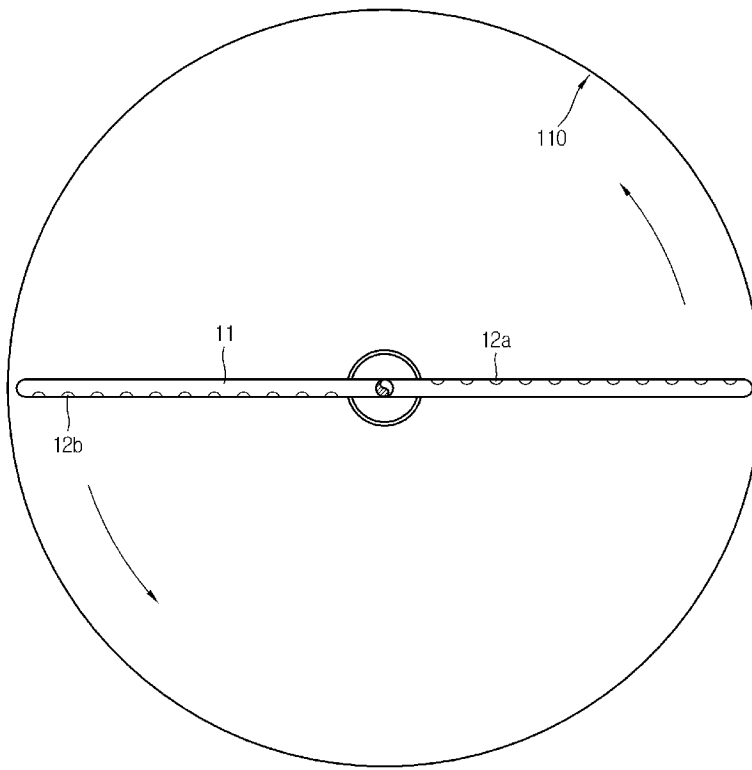
[Fig. 1]



[Fig. 2]

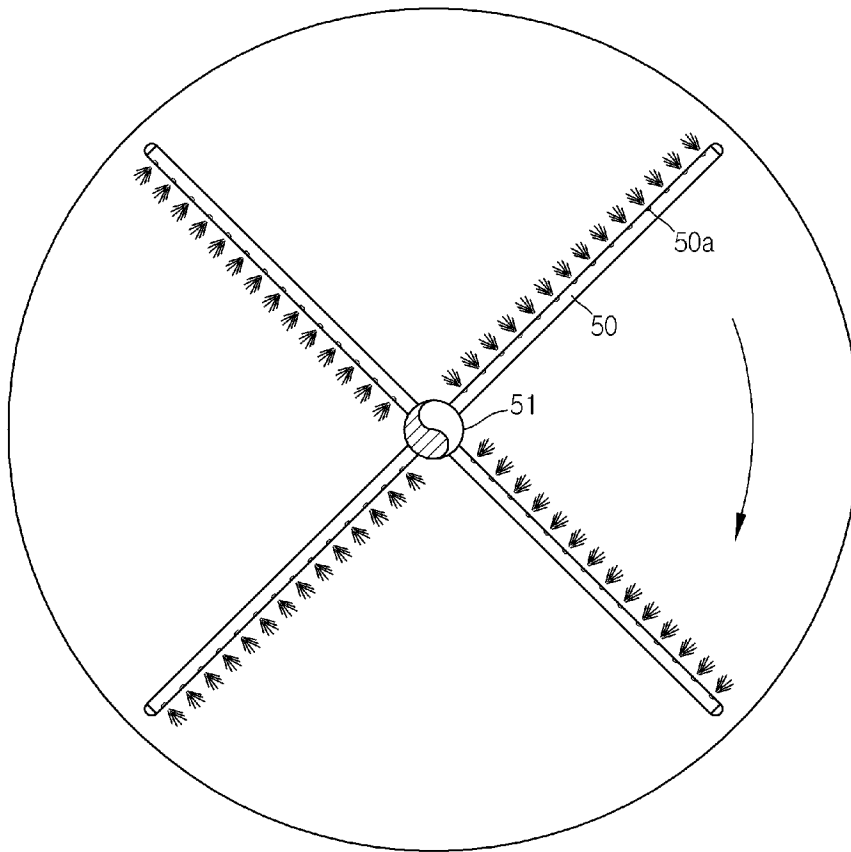


[Fig. 3]

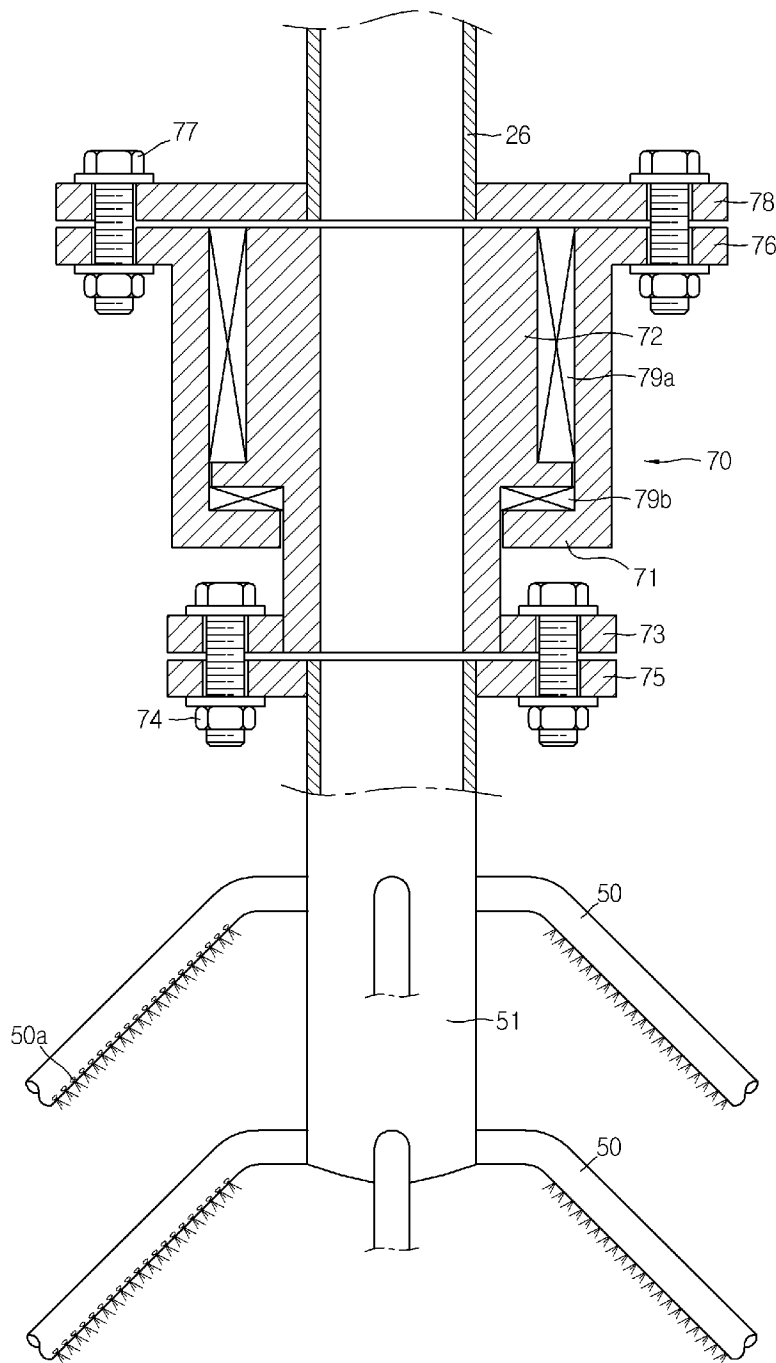


This diagram shows a cross-sectional view of a mechanical assembly. A central vertical shaft (13) is the main component. At the top, the shaft passes through a housing (11) which has a top flange (11a). The shaft is supported by bearings (15a) and has a piston (13e) with seals (13f) at the bottom. The housing has a bottom flange (20a). The shaft is secured with nuts and washers (13b, 13c, 13d). The shaft is also connected to a horizontal member (13b) which is secured with a nut and washer (13c). The shaft is also connected to a horizontal member (13b) which is secured with a nut and washer (13c). The shaft is also connected to a horizontal member (13b) which is secured with a nut and washer (13c).

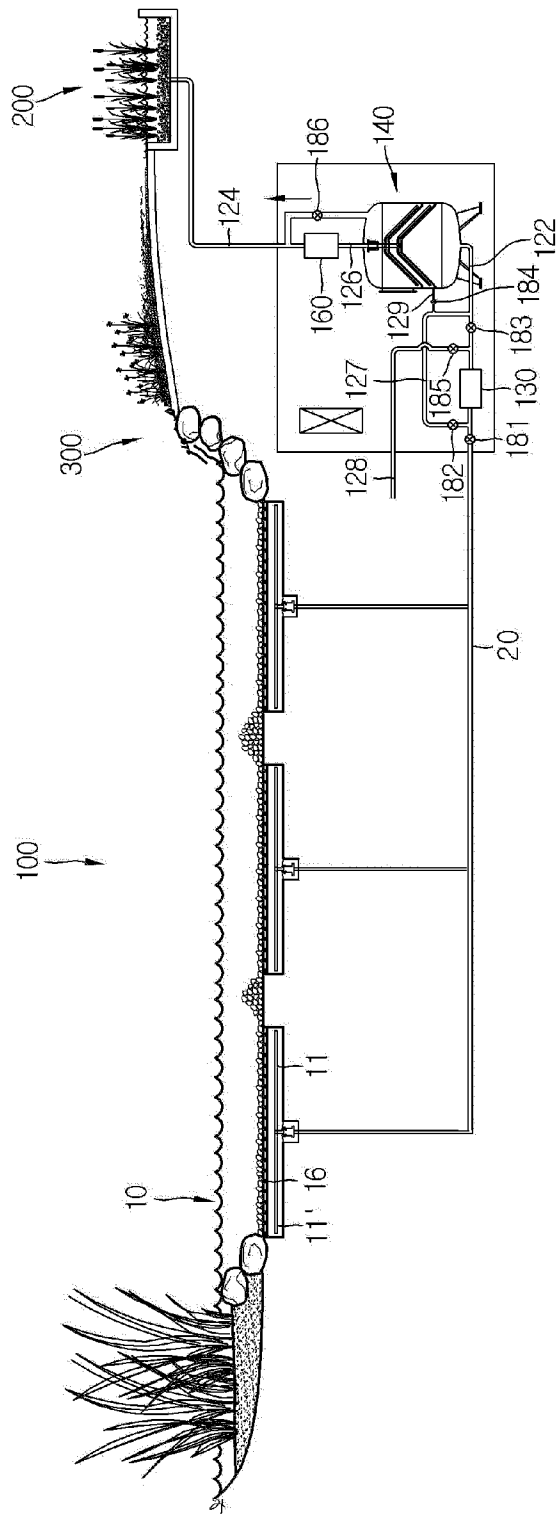
[Fig. 6]



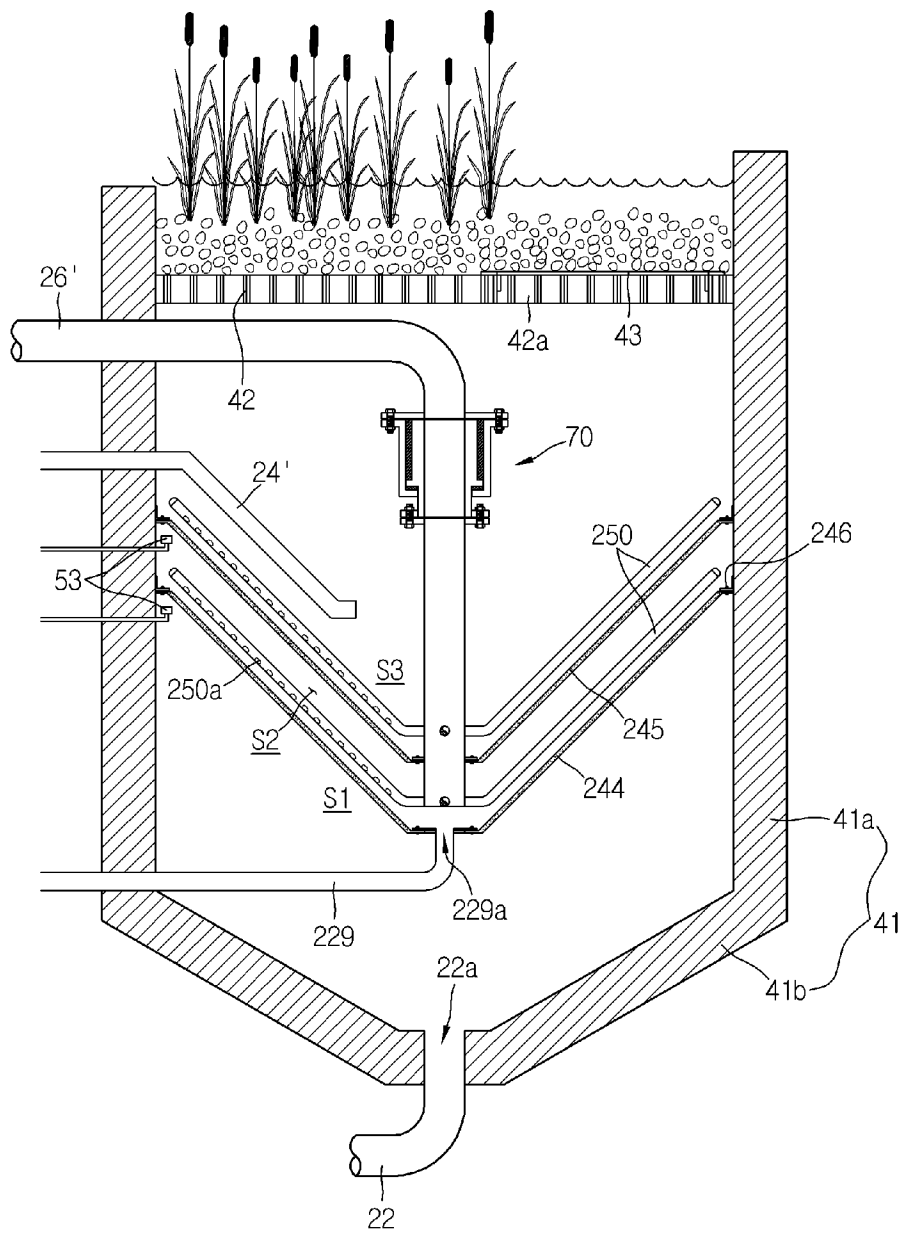
[Fig. 7]



[Fig. 8]



[Fig. 10]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/002745**A. CLASSIFICATION OF SUBJECT MATTER*****B01D 65/02(2006.01)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)

IPC 8 B01D 29/04, 35/02, CO2F 1/68, 1/00

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

Korean Patents and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and application for Utility models since 1975

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

eKIPASS, Delphion, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3004632 Y(NAGANO YOJI) 26 January 1993 see abstract, figure 1	1-36
A	JP 57045313 A(HITACHI LTD) 15 March 1982 see abstract, figure 1,2	1-36
A	KR 0171326 Y(POSCO) 07 September 1993 see abstract	1-36
A	JP 10024298 A(ROORERU KK) 27 January 1998 see abstract	1-36



Further documents are listed in the continuation of Box C.



See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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

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Date of the actual completion of the international search

07 APRIL 2006 (07.04.2006)

Date of mailing of the international search report

11 APRIL 2006 (11.04.2006)

Name and mailing address of the ISA/KR

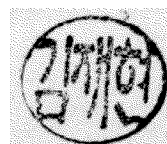
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Telephone No. 82-42-481-5634



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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