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(54) **Title**: HOLLOW FILTER DISC AND LAMINATED FILTER COMPRISING THE SAME

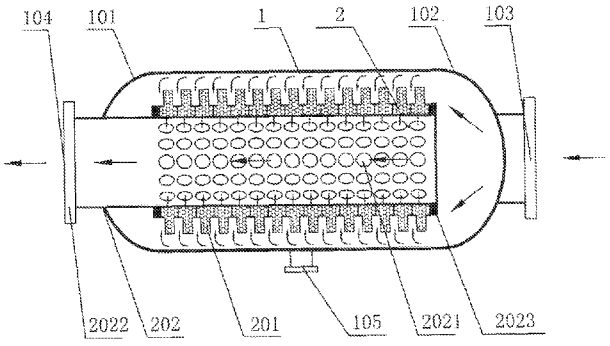

FIG. 2

(57) **Abstract**: Disclosed are a hollow filter disc (201) and a laminated filter comprising the same. The hollow filter disc (201) comprises two annular disc pieces (2011) with filtering pores and an internally hollow annular frame (2012) sized and shaped to match with the annular disc pieces (2011), wherein a number of throughholes (2014) are provided at the inner periphery of the annular frame (2012), and each of the annular disc pieces (2011) is pressed and detachably secured to the corresponding one of the annular surfaces of the annular frame (2012) and is sealed against it at the junctions therebetween, thus forming a water reservoir chamber between the two annular disc pieces (2011) and the annular frame (2012). The laminated filter has a filter core composed of a group of the said hollow filter discs (201) and a water outflow core pipe (202) provided with a number of water inlet orifices (2021) at it periphery, wherein the hollow filter discs (201) are inserted through by the water outflow core pipe (202). The laminated filter may be provided with an automatic cleaning device or an unpowered automatic cleaning device.

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Hollow Filter Disc and Laminated Filter Comprising the Same

Technical Field

The present invention relates to a filter disc and a large flow rate filter comprising the same, in particular to a hollow filter disc and a filter comprising a filter core composed of a number of the hollow filter discs which are laminated together. The present invention belongs to the technical field of filtering apparatus.

Background Art

Automatic laminated filters, which are widely used in developed countries, generally comprises a filter housing and a filter core, wherein the filter core is a hollow cylinder which consists of a multitude of annular discs having grooves at two sides and assembled on a central frame. The annular discs are pressed by springs at two ends of the central frame and also by the water pressure so as to form a filtering body, and fluid flows through a gap formed between every two discs. Since a filtering surface is formed within the gap between every two discs, the filtered flow rate of a single filter disc is small. Once a filter is assembled, its filtering capacity is fixed and is small because of the small filtering surface. Furthermore, because the size of the gaps between the discs after being pressed is fixed, the filtering effect is fixed and cannot meet different filtering requirements.

The above prior art laminated filter is generally cleaned by backwashing. During a backwashing process, the direction of the water flow in a filter unit is varied by means of a backwash valve, the springs pressed on the filter core is pushed away by water pressure and all the small gaps between the discs are expanded, and a tube located at the center of the filter core injects water along a tangent direction to rotate the discs. Accordingly, with the washing of the water and centrifugal force generated by high speed rotation of the discs, substances remained on the discs are flushed out. After the backwashing process, the discs are re-pressed and recovered to a filtering state by means of the springs on the filter core. The filtering effect of this filter is good, but it is difficult for the backwashing water to clean off the filth adhering to the

discs, thus the filtering effect will certainly be affected as time goes by. Because the filter is used in a filtering system of large water flow rate, cleaning problem is particularly significant. It can only be thoroughly cleaned by manual washing, which requires a great amount of labor force and high cost, and also the machine has to be stopped during cleaning, such that the system cannot operate continuously.

Therefore, there is a need for a hollow filter disc, which has a large filtering surface, is suitable for large flow rate and can meet different filtering requirements so as to overcome the above defects. There is also a need for a large flow rate filter, which allows on-line automatic cleaning, is able to meet different filtering requirements and involves low cost and high efficiency.

Summary of the Invention

One of the objects of the present invention is to provide a hollow filter disc which has a large filtering surface and is suitable for different filtering requirements and large flow rate filtering.

A technical solution for achieving this object is as follows:

A hollow filter disc comprises two annular disc pieces with filtering pores and an internally hollow annular frame sized and shaped to match with the disc pieces, at the inner periphery of the annular frame being provided a number of throughholes, and each of the two annular disc pieces being pressed and detachably secured to the corresponding one of the two annular surfaces of the annular frame and also being sealed against it at the junctions therebetween, thereby forming a water reservoir chamber between the two annular disc pieces and the annular frame.

For achieving better filtering effect, one or more of the following technical features may be employed:

1. An outer periphery of the annular frame is provided with filtering pores or is sealed against water.

2. An internal ring of the annular frame projects beyond the annular surfaces thereof to form a projecting shoulder.

3. The outer periphery of the annular disc pieces is circular.

4. The outer periphery of the annular disc pieces is oval, or square, or any other

non-circular shape, and the annular frame and the outer periphery thereof are sized and shaped to match with the outer periphery of the annular disc pieces.

5. The inner side and/or outer side of the annular disc pieces with filtering pores and of the outer periphery of the annular frame is adhered with a porous filtering mesh whose pore size may be different according to actual needs.

The second object of the present invention is to provide a filter, which is suitable for large flow rate filtering and different filtering requirements, and involves low cost and high efficiency.

A technical solution for achieving this second object is as follows:

A laminated filter comprises a housing and a filter core, the housing being a cylinder having end caps at two ends, a water inlet and a water outlet of the filter being disposed at the two end caps or at a periphery surface of the cylinder, wherein the filter core comprises a group of hollow filter discs according to the first object of the present invention and a water outflow core pipe with water inlet orifices at its periphery, and the hollow filter discs are inserted through by the water outflow core pipe with intervals being present between opposite disc surfaces of two adjacent hollow filter discs; and wherein the outflow water from the throughholes at the inner periphery of the annular frame of each of the hollow filter discs flows into the water outflow core pipe via the water inlet orifices thereof, the hollow filter discs are sealed against the water outflow core pipe to prevent raw water from flowing into the water outflow core pipe, and one end of the water outflow core pipe is closed and the other end is provided with a water outlet which is connected to the water outlet of the filter or directly functions as the water outlet of the filter.

For achieving better filtering effect, one or more of the following technical features may be employed:

1. The hollow filter discs may comprise various annular disc pieces adhered with a porous filtering mesh of different pore size for replacement according to different filtering requirements, which greatly reduces investment cost of the apparatus.

2. The projecting shoulders of two adjacent hollow filter discs are pressed to and sealed against each other, and each of the two hollow filter discs approximate to one

of the two ends of the water outflow core pipe is sealed against the latter by means of a sealing sleeve.

3. The cylinder of the housing is provided with a sewage outlet.

The advantages of the above hollow filter disc and the laminated filter according to the present invention are as follows:

1. The hollow filter disc is composed of two annular disc pieces, which have filtering pores and are each pressed onto one of the two annular surfaces of the annular frame, and the surfaces of the two annular disc pieces function as filtering surfaces, thereby the filtering surface area and thus the filtered flow rate is greatly improved compared with the prior art laminated filter.

2. The hollow filter disc may have filtering pores at its outer periphery, thus greatly increasing the filtering area and the filtered flow rate of an individual filter disc.

3. The inner side and/or outer side of the annular disc pieces as well as of the outer periphery of the annular frame may be adhered with a porous filtering mesh whose pore size may be adapted to actual needs, and the disc pieces of the hollow filtering disc may be detachably secured to the annular frame, thus various annular disc pieces adhered with a porous filtering mesh of different pore size may be produced, so as to form different hollow filtering discs and thus different filters to meet different filtering requirements. The various annular disc pieces may be interchanged with each other according to actual needs, thereby the investment cost of the apparatus is greatly reduced.

4. The filter core of the laminated filter is composed of a group of hollow filter discs according to the first object of the present invention and a water outflow core pipe with water inlet orifices at its periphery, thus the filtering area of an individual filter disc and of the entire filter are greatly increased compared with the prior art, and also large flow rate filtering requirement is satisfied.

The third object of the present invention is to provide a laminated filter with an automatic cleaning device, which filter is suitable for large flow rate filtering and online automatic cleaning, and involves low cost and high efficiency.

A technical solution for achieving this third object is as follows:

A laminated filter with an automatic cleaning device comprises a housing and a filter core, the housing being a cylinder having end caps at two ends, and a water inlet and a water outlet of the filter being disposed at the two end caps or approximate to the ends of the cylinder, wherein the filter core comprises a group of hollow filter discs according to the first object of the present invention and a water outflow core pipe with water inlet orifices at its periphery, and the hollow filter discs are inserted through by the water outflow core pipe with intervals being present between opposite disc surfaces of two adjacent hollow filter discs; and wherein the outflow water from a number of water outlet orifices provided at the inner periphery of each of the hollow filter discs flows into the water outflow core pipe via the water inlet orifices thereof, the water outflow core pipe and the hollow filter discs are sealed against each other at the junctions therebetween to prevent raw water from flowing into the water outflow core pipe, and one end of the water outflow core pipe is closed and the other end is provided with a water outlet which is connected to the water outlet of the filter or directly functions as the water outlet of the filter; and wherein the automatic cleaning device comprises a cleaning brush frame, a number of cleaning brushes, a drive means and an installation frame, the installation frame being connected to the drive means, the cleaning brush frame being secured to the installation frame, and the cleaning brushes being each secured to the cleaning brush frame so that their cleaning brush heads being each located on a surface of the hollow filter discs; and wherein the drive means drives the installation frame and thus the cleaning brush frame to rotate.

For achieving better filtering effect, one or more of the following technical features may be employed:

1. Each of the hollow filter discs is composed of two annular disc pieces with filtering pores and an internally hollow annular frame sized and shaped to match with the annular disc pieces, at the inner periphery of the annular frame being provided with throughholes, and each of the two annular disc pieces being pressed and detachably secured to the corresponding one of the two annular surfaces of the annular frame and also being sealed against it at the junctions therebetween, thereby

forming a water reservoir chamber between the two annular disc pieces and the annular frame.

2. The inner side and/or outer side of the annular disc pieces with filtering pores is adhered with a porous filtering mesh whose pore size may be varied according to actual needs. That is, various annular disc pieces adhered with a porous filtering mesh of different pore size may be produced for replacement purpose so as to meet different filtering requirements.

3. A high pressure flushing device is further included for better cleaning off the filth on the disc surfaces, said high pressure flushing device being provided on the water outlet pipe thereof with a number of injection openings from which water is injected at an angle onto the surfaces of the annular disc pieces to clean off the filth in time.

4. The water inlet orifices at the periphery of the water outflow core pipe are correspondingly communicated to the water outlet orifices at the inner periphery of the annular frame, and the water outflow core pipe and the annular frame are sealed against each other at the junctions therebetween.

5. Each of the annular filter discs is sealed at its two lateral sides against the water outflow core pipe at the junctions therebetween.

6. A sewage outlet is provided at the cylinder of the housing to expel the sewage water produced by cleaning of the disc pieces.

The advantages of the above laminated filter with an automatic cleaning device are as follows:

1. An automatic cleaning device comprising a number of brushes is included, enabling a better cleaning off of the filth on the filtering surfaces, avoiding blocking of the filter pores and keeping the filtering efficiency;

2. The automatic cleaning device can accomplish online real time cleaning, thereby ensuring continuous operation of the system and significantly saving labor cost;

3. A high pressure flushing device may be included for flushing off the filth on the surfaces of the disc pieces with pressurized water and also for aiding in cleaning

off the filth in time during brushing of the disc pieces by the cleaning brushes, thereby the cleaning effect is improved and the filtering effect of the system is ensured;

4. The filter core is composed of a group of hollow filter discs and a water outflow core pipe, wherein each of the hollow filter discs comprises two annular disc pieces with filtering pores, each of which is pressed and secured to the corresponding one of the two annular surfaces of a annular frame; since the surfaces of the two annular disc pieces function as filtering surfaces, which are larger than filtering surface area of prior art laminated filter, the filtered flow rate can be greatly improved.

5. Each of the hollow filter discs comprises two annular disc pieces with filtering pores, each of which is pressed and detachably secured to the corresponding one of the two surfaces of a annular frame, wherein the inner side and/or outer side of the annular disc pieces is adhered with a porous mesh whose pore size may be varied according to actual needs, therefore, various annular disc pieces adhered with a porous filtering mesh of different pore size may be produced for interchange according to different filtering requirements.

The fourth object of the present invention is to provide a laminated filter with an unpowered automatic cleaning device, which filter is suitable for large flow rate filtering and online automatic cleaning, and involves low cost and high efficiency.

A technical solution for achieving this fourth object is as follows:

A laminated filter with an unpowered automatic cleaning device comprises a housing and a filter core, the housing being a cylinder having end caps at two ends, and a water inlet and a water outlet of the filter being disposed at the two end caps or approximate to the ends of the cylinder, wherein the filter core comprises a group of hollow filter discs according to the first object of the present invention and a water outflow core pipe with water inlet orifices at its periphery, and the hollow filter discs are inserted through by the water outflow core pipe with intervals being present between opposite disc surfaces of two adjacent hollow filter discs; and wherein the outflow water from a number of water outlet orifices provided at the inner periphery of each of the hollow filter discs flows into the water outflow core pipe via the water

inlet orifices thereof, the water outflow core pipe and the hollow filter discs are sealed against each other at the junctions therebetween to prevent raw water from flowing into the water outflow core pipe, and one end of the water outflow core pipe is closed and the other end is provided with a water outlet which is connected to the water outlet of the filter or directly functions as the water outlet of the filter; and wherein the unpowered automatic cleaning device comprises a cleaning brush frame, a number of cleaning brushes, a drive means and an installation frame, the installation frame being connected to the drive means, the cleaning brush frame being secured to the installation frame, and the cleaning brushes being each secured to the cleaning brush frame so that their cleaning brush heads being each located on a surface of the hollow filter discs; and wherein the drive means is installed inside one of the end caps of the filter to be driven in rotation by the impulse of the inflow water, and the drive means in turn drives the installation frame and thus the cleaning brush frame to rotate.

For achieving better filtering effect, one or more of the following technical features may be employed:

1. The drive means of the unpowered automatic cleaning device is an impeller installed at the water inlet end of the filter, and is driven in rotation by the impulse of the inflow water, thereby driving the cleaning device to rotate so as to achieve cleaning of the disc pieces.

2. Each of the hollow filter discs is composed of two annular disc pieces with filtering pores and an internally hollow annular frame sized and shaped to match with the annular disc pieces, at the inner periphery of the annular frame being provided with a number of throughholes, and each of the two annular disc pieces is pressed and detachably secured to the corresponding one of the two annular surfaces of the annular frame and is sealed against it at the junctions therebetween, thus forming a water reservoir chamber between the two annular disc pieces and the annular frame.

3. The inner side and/or outer side of the annular disc pieces with filtering pores is adhered with a porous filtering mesh whose pore size may be varied according to actual needs. In other words, various annular disc pieces adhered with a porous filtering mesh of different pore size may be produced for replacement purpose

according to different filtering requirements.

4. A high pressure flushing device is further included for better cleaning off the filth on the disc surfaces, said high pressure flushing device being provided on the water outlet pipe thereof with a number of injection openings from which water is injected at an angle onto the disc surfaces of the annular disc pieces to clean off the filth in time.

5. The water inlet orifices at the periphery of the water outflow core pipe are correspondingly communicated to the water outlet orifices at the inner periphery of the annular frame, and the water outflow core pipe and the annular frame are sealed against each other at the junctions therebetween.

6. Each of the annular filter discs is sealed at its two sides against the water outflow core pipe at the junctions therebetween.

7. A sewage outlet is provided at the cylinder of the housing to expel the sewage water produced by cleaning of the disc pieces.

The advantages of the above laminated filter with an unpowered automatic cleaning device are as follows:

1. An automatic cleaning device comprising a number of brushes is included, enabling a better cleaning off of the filth on the filtering surfaces, avoiding blocking of the filter pores and keeping the filtering efficiency;

2. The drive means of the unpowered automatic cleaning device is an impeller installed at the water inlet end of the filter, and is driven in rotation by the impulse of the inflow water, thereby driving the cleaning device to rotate so as to enable cleaning of the disc pieces. No additional power source is needed, thus it is energy-saving, environmental friendly and low-cost for operation;

3. The automatic cleaning device may accomplish online real time cleaning, thereby ensuring continuous operation of the system and significantly saving labor cost;

4. A high pressure flushing device is included for flushing off the filth on the surfaces of the disc pieces with pressurized water and also for aiding in cleaning off the filth in time during brushing of the disc pieces by the cleaning brushes, thereby the

cleaning effect is improved and the filtering effect of the system is ensured.

5. The filter core is composed of a group of hollow filter discs and a water outflow core pipe, wherein each of the hollow filter discs comprises two annular disc pieces with filtering pores, which are each pressed and secured to the corresponding one of the two annular surfaces of a annular frame, and the surfaces of the two annular disc pieces function as filtering surfaces, which are larger than the filtering surface area of prior art laminated filter, therefore the filtered flow rate can be greatly improved.

6. Each of the hollow filter discs comprises two annular disc pieces with filtering pores which are each pressed and detachably secured to the corresponding one of the two faces of a annular frame, wherein the inner side and/or outer side of each of the annular disc pieces is adhered with a porous filtering mesh whose pore size may be varied according to actual needs; therefore, various annular disc pieces adhered with a porous filtering mesh of different pore size may be produced for interchange according to different filtering requirements.

It is to be noted that, as used herein throughout the whole context, the term "number" means one or an integer more than one.

Brief Description of the Drawings

Fig. 1a is a main view of the hollow filter disc according to the first object of the present invention.

Fig. 1b is a sectional view of the hollow filter disc of Fig. 1a taken along an line A-A, which illustrates schematically the explosion view of the hollow filter disc prior to assembly;

Fig. 2 is a schematic, sectional view of the laminated filter according to an embodiment of the second object of the present invention.

Fig. 3a is a schematic view of the laminated filter with an automatic cleaning device according to an embodiment of the third object of the present invention, which illustrates the cleaning brushes.

Fig. 3b is a schematic view of the laminated filter with an automatic cleaning device according to another embodiment of the third object of the present invention,

which illustrates the cleaning brushes and the flushing device.

Fig. 4a is schematic view of the laminated filter with an unpowered automatic cleaning device according to an embodiment of the fourth object of the present invention, which illustrates the cleaning brushes.

Fig. 4b is a schematic view of the laminated filter with an unpowered automatic cleaning device according to another embodiment of the fourth object of the present invention, which illustrates the cleaning brushes and the flushing device.

In the figures, 1 represents a cylinder; 101, 102 represent the end caps; 103 represents a water inlet of the filter; 104 represents a water outlet of the filter; 105 represents a sewage outlet; 2 represents a filter core; 201 represents a hollow filter disc; 2011 represents an annular disc piece; 2012 represents an annular frame; 2013 represents a porous filtering mesh on an annular disc piece; 2014 represents the water outlet orifices at the inner periphery of the annular frame; 202 represents a water outflow core pipe; 2021 represents the water inlet orifices on the water outflow core pipe; 2022 represents a water outlet of the water outflow core pipe; 2023 represents a sealing sleeve; 3 represents a cleaning device; 301 represents a cleaning brush frame; 3011 represents a trunk rod; 3012 represents a branching rod; 302 represents the cleaning brushes; 303 represents a drive means; 304 represents an installation frame; 305 represents a stop plate; 4 represents a high pressure flushing device; 401 represents a high pressure pump; 402 represents a water inlet tube of the high pressure pump; 403 represents an outflow water transporting pipe of the high pressure pump; 404 represents a water transporting branching pipe; 405 represents the injection tubes.

Detailed Description of the Embodiments

Embodiment 1

One embodiment of the first object of the present invention will be described in detail with reference to Figs. 1a and 1b:

As shown in Figs. 1a and 1b, a hollow filter disc 201 in this embodiment includes two annular disc pieces 2011 with filtering pores and an internally hollow annular frame 2012 sized and shaped to match with the annular disc pieces. A number of throughholes are provided at an inner periphery of the annular frame 2012, and an

internal ring of the annular frame projects beyond the annular surfaces thereof to form a projecting shoulder. The outer periphery of the annular frame 2012 in this embodiment is sealed against water. Each of the two annular disc pieces 2011 is pressed and detachably secured to the corresponding one of the two annular surfaces of the annular frame 2012 and is sealed against it at the junctions therebetween, such that a water reservoir chamber is formed between the two annular disc pieces 2011 and the annular frame 2012. In order to produce better filtering effects and adapt to different filtering requirements, the inner side and/or outer side of each of the annular disc pieces 2011 with filtering pores is adhered with a porous filtering mesh whose pore size may be varied according to actual needs.

In practice, the outer periphery of the annular frame 2012 may also have filtering pores therein, in this case, the inner side and/or outer side of the outer periphery of the annular frame may be adhered with a similar porous filtering mesh as the one adhered to the inner side and/or outer side of the annular disc pieces 2011.

The outer periphery of the annular disc pieces 2011 in this embodiment is circular. It may also be oval, or square or any other non-circular shape, and the annular frame 2012 and its outer periphery are sized and shaped to match with the annular disc pieces.

Embodiment 2

An embodiment of the second object of the present invention will be described in detail with reference to Fig. 2:

As shown in Fig. 2, a laminated filter comprises a housing and a filter core. The housing is a cylinder 1 having end caps at two ends, and a water inlet and a water outlet of the filter respectively are disposed on the two end caps. The filter core 2 consists of a group of hollow filter discs 201 according to the first object of the present invention and a water outflow core pipe 202 provided with a number of water inlet orifices 2021 at its periphery. The hollow filter discs 201 are inserted through by the water outflow core pipe 202. Two adjacent hollow filter discs 201 are pressed and sealed against each other at the projecting shoulders thereof with intervals being present between the opposite disc surfaces of the two adjacent hollow filter discs 201.

Each of the two hollow filter discs 201, which is located approximate to the corresponding one of the two ends of the water outflow core pipes 202, is sealed against the water outflow core pipe 202 by means of a sealing sleeve 2023. The outflow water from the throughholes 2014 provided at the inner periphery of the annular frame of each of the hollow filter discs 201 flows into the water outflow core pipe 202 via the water inlet orifices 2021 thereof. The hollow filter discs 201 are sealed against the water outflow core pipe 202 at the junctions therebetween to prevent raw water from flowing into the water outflow core pipe 202. One end of the water outflow core pipe 202 is closed and the other end is provided with a water outlet 2022 which is connected to the water outlet 104 of the filter or directly functions as the water outlet 104 of the filter. In this embodiment the water outlet 2022 directly functions as the water outlet 104 of the filter.

In this embodiment, in addition to the filtering pores on the surfaces of the annular disc pieces 2011, its inner side and/or outer side is adhered with a porous filtering mesh. In practice, various annular disc pieces adhered with a porous filtering mesh of different pore size may be manufactured for interchange according to different filtering requirements, enabling assembly of a filter disc and thus a filter suitable for different filtering requirements so as to reduce investment cost of the apparatus. The cylinder 1 is further provided with a sewage outlet 105.

Two embodiments of the third object of the present invention will described in detail with reference to Figs. 3a and 3b.

Embodiment 3

As shown in Fig. 3a, a laminated filter with an automatic cleaning device comprises a housing and a filter core. The housing is a cylinder 1 having end caps at two ends, and a water inlet of the filter is located approximate to one end cap and a water outlet of the filter is located on the other end cap 101. The filter core 2 consists of a group of hollow filter discs 201 according to the first object of the present invention and a water outflow core pipe 202 provided with a number of water inlet orifices 2021 at its periphery. The hollow filter discs 201 are inserted through by the water outflow core pipe 202. Two adjacent hollow filter discs 201 are pressed and

sealed against each other at the projecting shoulders thereof with intervals being present between the opposite disc surfaces of the two adjacent hollow filter discs 201. Each of the two hollow filter discs 201, which is located approximate to the corresponding one of the two ends of the water outflow core pipes 202, is sealed against the water outflow core pipe 202 by means of a sealing sleeve 2023. The outflow water from a number of throughholes 2014 provided at the inner periphery of the hollow filter discs 201 flows into the water outflow core pipe 202 via the water inlet orifices 2021 thereof. The water outflow core pipe 202 and the hollow filter discs 201 are sealed against each other at the junctions therebetween to prevent raw water from flowing into the water outflow core pipe 202. One end of the water outflow core pipe 202 is closed and the other end is provided with a water outlet 2022 which is directly used as the water outlet 104 of the filter.

The automatic cleaning device comprises a cleaning brush frame 301, a number of cleaning brushes 302, a drive means 303, an installation frame 304 and a stop plate 305. In this embodiment, the drive means 303 is an electric motor which is installed at the end cap 102 of the filter, and the installation frame 304 is secured to a shaft of the electric motor 303. The cleaning brush fame 301 includes a trunk rod 3011 with its one end being secured to the stop plate 305 and the other end being secured to the installation frame 304, and also includes a number of branching rods 3012 connected to the trunk rod 3011. The trunk rod 3011 is located at the outside of the hollow filter discs 201. The cleaning brushes 302 are provided on the branching rods 3012 such that their cleaning brush heads rest on the surfaces of the annular filter discs 201. Each of the cleaning brush heads has a length no less than a radial width of each of the annular disc pieces 2011, and also has a rotation range covering an entire surface of each of the annular disc pieces 2011. A cleaning brush head between two adjacent annular disc pieces 2011 can simultaneously brush the two surfaces of the two adjacent annular disc pieces at opposite sides. In order to produce better cleaning effects, each of the cleaning brush heads may be made to simultaneously brush the outer periphery of the annular frame 2012. When the filter operates, the electric motor 303 drives the cleaning brush frame 301 to rotate so that the cleaning brush heads can

clean off the filth on the surfaces of the annular disc pieces. A sewage outlet 105 is disposed on the cylinder 1 to expel the sewage water produced by cleaning of the hollow filter discs 201.

Embodiment 4

As shown in Fig. 3b, in order to better clean off the filth on the disc surfaces, the cleaning device, different from that in the above embodiment three, further comprises a high pressure flushing device 4. The high pressure flushing device 4 comprises a high pressure pump 401, a water inlet pipe 402 of the high pressure pump 401, an outflow water transporting pipe 403 of the high pressure pump 401, a number of water transporting branching pipes 404 and a number of injection tubes 405. One end of the outflow water transporting pipe 403 is connected to a water outlet of the high pressure pump 401, and the other end is secured to the installation frame 304 and is herein divided into a number of water transporting branching pipes 404, with the other end of the water transporting branching pipes 404 being secured to the stop plate 305. The water transporting branching pipes 404 are located at the outside of the hollow filter discs 201 and each of the water transporting branching pipes 404 is provided with a number of injection tubes 405, which extend into the disc surfaces of the hollow filter discs 201 and are provided with a number of injection openings from which water is injected at an angle onto the disc surfaces of the annular disc pieces 2011.

Two embodiments of fourth object of the present invention will be described in detail with reference to Figs. 4a and 4b:

Embodiment 5

As shown in Fig. 4a, a laminated filter with an unpowered automatic cleaning device comprises a housing and a filter core. The housing is a cylinder 1 having end caps at two ends, and a water inlet 103 of the filter is located on the end cap 102 and a water outlet 104 of the filter is located on the end cap 101. The filter core 2 consists of a group of hollow filter discs 201 according to the first object of the present invention and a water outflow core pipe 202 provided with a number of water inlet orifices 2021 at its periphery. The hollow filter discs 201 are inserted through by the water outflow

core pipe 202. Two adjacent hollow filter discs 201 are pressed and sealed against each other at the projecting shoulders thereof with intervals being present between the disc surfaces of the two adjacent hollow filter discs 201. Each of the two hollow filter discs 201, which is located approximate to the corresponding one of the two ends of the water outflow core pipes 202, is sealed against the water outflow core pipe 202 by means of a sealing sleeve 2023. The outflow water from a number of throughholes 2014 provided at the inner periphery of the hollow filter discs 201 flows into the water outflow core pipe 202 via the water inlet orifices 2021 thereof. The water outflow core pipe 202 and the hollow filter discs 201 are sealed against each other at the junctions therebetween to prevent raw water from flowing into the water outflow core pipe 202. One end of the water outflow core pipe 202 is closed and the other end is provided with a water outlet 2022 which is directly used as the water outlet 104 of the filter.

The unpowered automatic cleaning device comprises a cleaning brush frame 301, a number of cleaning brushes 302, a drive means 303, an installation frame 304 and a stop plate 305. In this embodiment, the drive means 303 is an impeller which is installed in proximity to the end cap 102 of the filter, and the installation frame 304 is secured to a shaft of the impeller 303. The cleaning brush fame 301 includes a trunk rod 3011 with its one end being secured to the stop plate 305 and the other end being secured to the installation frame 304, and also includes a number of branching rods 3012 connected to the trunk rod 3011. The trunk rod 3011 is located at the outside of the hollow filter discs 201. The cleaning brushes 302 are provided on the branching rods 3012 such that their cleaning brush heads rest on the surfaces of the annular filter discs 201. Each of the cleaning brush heads has a length no less than a radial width of the annular disc pieces 2011, and also has a rotation range covering an entire surface of the annular disc pieces 2011. A cleaning brush head between two adjacent annular disc pieces 2011 can simultaneously brush the two surfaces of the two adjacent annular disc pieces at opposite sides. In order to produce better cleaning effects, the cleaning brush heads may be made to simultaneously brush the outer periphery of the annular frame 2012. When the filter operates, the impeller 303 is driven in rotation by

the impulse of the inflow water, thus drives the cleaning brush frame 301 to rotate so that the cleaning brush heads can clean off the filth on the surfaces of the annular disc pieces. A sewage outlet 105 is disposed on the cylinder 1 to expel the sewage water produced by cleaning of the hollow filter discs 201.

Embodiment 6

As shown in Fig. 4b, in order to better clean off the filth on the disc surfaces, the cleaning device, different from that in the above embodiment five, further comprises a high pressure flushing device 4. The high pressure flushing device 4 comprises a high pressure pump 401, a water inlet pipe 402 of the high pressure pump 401, an outflow water transporting pipe 403 of the high pressure pump 401, a number of water transporting branching pipes 404 and a number of injection tubes 405. One end of the outflow water transporting pipe 403 is connected to a water outlet of the high pressure pump 401, and the other end is secured to the installation frame 304 and is herein divided into a number of water transporting branching pipes 404, with the other end of the water transporting branching pipes 404 being secured to the stop plate 305. The water transporting branching pipes 404 are located at the outside of the hollow filter discs 201 and each of the water transporting branching pipes 404 is provided with a number of injection tubes 405, which extend into the disc surfaces of the hollow filter discs 201 and are provided with a number of injection openings from which water is injected at an angle onto the disc surfaces of the annular disc pieces 2011.

The hollow filter disc and the filter comprising the same according to the present invention can find a wide application in filtering of vessel ballast water, heat exchanger water, circulating cooling water, nozzle water, pre-treated water for super filtering and micro filtering, water softening system, waste water, recycle water, and water used in food, medicine, vehicle, electronics, metallurgy, chemistry, culture, agricultural irrigation industries and etc.

What we claimed is:

1. A hollow filter disc (201), which comprises two annular disc pieces (2011) with filtering pores and an internally hollow annular frame (2012) sized and shaped to match with the annular disc pieces, a number of throughholes (2014) being provided at the inner periphery of the annular frame (2012), and each of the two annular disc pieces (2011) being pressed and detachably secured to the corresponding one of the two annular surfaces of the annular frame (2012) and being sealed against said corresponding one annular surface at the junctions therebetween, thereby forming a water reservoir chamber between the two annular disc pieces (2011) and the annular frame (2012).

2. The hollow filter disc according to claim 1, characterized in that the annular frame (2012) has filtering pores at its outer periphery.

3. The hollow filter disc according to claim 1, characterized in that the outer periphery of the annular frame (2012) is sealed against water.

4. The hollow filter disc according to claim 1, characterized in that an internal ring of the annular frame (2012) projects beyond the annular surfaces thereof to form a projecting shoulder.

5. The hollow filter disc according to claim 1, characterized in that the periphery of the annular disc pieces (2011) is circular.

6. The hollow filter disc according to claim 1, characterized in that the outer periphery of the annular disc pieces (2011) is oval, or square or any other non-circular shape, and the annular frame (2012) and its outer periphery are sized and shaped to match with the annular disc pieces.

7. The hollow filter disc according to claim 1 or 2, characterized in that the inner side and/or outer side of the annular disc pieces (2011) with filtering pores and of the outer periphery of the annular frame (2012) is adhered with a porous filtering mesh, whose pore size may be varied according to actual needs.

8. A laminated filter, which comprises a housing and a filter core (2), said housing being a cylinder (1) having end caps at two ends, and a water inlet and a water outlet of the filter being disposed at the periphery of the cylinder (1) or at the

two end caps, wherein the filter core (2) comprises a group of hollow filter discs (201) according to claim 1 and a water outflow core pipe (202) provided with a number of water inlet orifices (2021) at its periphery, the hollow filter discs (201) being inserted through by the water outflow core pipe (202) with intervals being present between two opposite disc surfaces of two adjacent hollow filter discs; and wherein outflow water from a number of throughholes provided at the inner periphery of the hollow filter discs (201) flows into the water outflow core pipe (202) via the water inlet orifices (2012) thereof, the water outflow core pipe (202) and the hollow filter discs (201) are sealed against each other at the junctions therebetween to prevent raw water from flowing into the water outflow core pipe (202), and one end of the water outflow core pipe (202) is closed and the other end is provided with a water outlet (2022) which is connected to a water outlet (104) of the filter or directly functions as the water outlet (104) of the filter.

9. The laminated filter according to claim 8, characterized in that the hollow filter discs (201) include various annular disc pieces adhered with a porous filtering mesh of different pore size for replacement according to different filtering requirements.

10. The laminated filer according to claim 8, characterized in that the projecting shoulders of two adjacent hollow filter discs (201) are pressed to and sealed against each other, and each of the two hollow filter discs (201) approximate to the corresponding one of the two ends of the water outflow core pipe (202) is sealed against the latter by means of a sealing sleeve (2023).

11. The laminated filter according to claim 8, characterized in that the cylinder (1) is provided with a sewage outlet (105).

12. A laminated filter with an automatic cleaning device, which comprises a laminated filter according to claim 8 and said automatic cleaning device, the latter including a cleaning brush frame (301), a number of cleaning brushes (302), a drive means (303) and an installation frame (304), wherein the installation frame (304) is connected to the drive means (303), the cleaning brush frame (301) is secured to the installation frame (304), and the cleaning brushes (302) are each secured to the

cleaning brush frame (301) such that their cleaning brush heads are each located on a surface of the hollow filter discs (201); and wherein the drive means (303) drives the installation frame (304) and thus the cleaning brush frame (301) to rotate.

13. The laminated filter with an automatic cleaning device according to claim 12, characterized in that the drive means (303) is an electric motor.

14. The laminated filter with an automatic cleaning device according to claim 12, characterized in that each cleaning brush head (302) only brushes one annular surface of the hollow filter discs (201).

15. The laminated filter with an automatic cleaning device according to claim 12, characterized in that each cleaning brush head (302) located between two adjacent hollow filter discs simultaneously brushes two opposite annular disc surfaces thereof.

16. The laminated filter with an automatic cleaning device according to claim 12, characterized in that each cleaning brush head (302) has a length no less than a radial width of the annular disc pieces.

17. The laminated filter with an automatic cleaning device according to claim 12, characterized in that the drive means (303) is installed on one end cap (102) of the cylinder, and the water inlet of the filter is located approximate to one end of the cylinder.

18. The laminated filter with an automatic cleaning device according to claim 12, characterized in that it further comprises a high pressure flushing device (4) with a number of water transporting branching pipes (404), and each of said water transporting branching pipes is provided with a number of injection tubes (405) from which water is injected onto the disc surfaces of the annular disc pieces (2011).

19. The laminated filter with an automatic cleaning device according to claim 12, characterized in that the inner side and/or outer side of the annular disc pieces with filtering pores is adhered with a porous filtering mesh, whose pore size may be varied according to actual needs.

20. The laminated filter with an automatic cleaning device according to claim 12, characterized in that the hollow filter discs include various annular disc pieces adhered with a porous filtering mesh of different pore size for replacement according

to different filtering requirements.

21. A laminated filter with an unpowered automatic cleaning device, which comprises a laminated filter according to claim 8 and said unpowered automatic cleaning device, the latter including a cleaning brush frame (301), a number of cleaning brushes (302), a drive means (303) and an installation frame (304), wherein the installation frame (304) is connected to the drive means (303), the cleaning brush frame (301) is secured to the installation frame (304), and the cleaning brushes (302) are each secured to the cleaning brush frame (301), such that their cleaning brush heads are each located on a surface of the hollow filter discs (201); and wherein the drive means (303) is installed inside one end cap (102) of the filter to be driven in rotation by the impulse of the inflow water, and the drive means (303) in turn drives the installation frame (304) and thus the cleaning brush frame (301) to rotate.

22. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that the drive means (303) is an impeller.

23. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that each cleaning brush head (302) only brushes one annular surface of the hollow filter discs (201).

24. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that each cleaning brush head (302) located between two adjacent hollow filter discs simultaneously brushes the two opposite annular disc surfaces thereof.

25. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that each cleaning brush head (302) has a length no less than a radial width of the annular disc pieces.

26. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that the drive means (303) is installed inside one end cap (102) of the cylinder, and the water inlet of the filter is located approximate to one end of the cylinder.

27. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that it further comprises a high pressure flushing device

(4) with a number of water transporting branching pipes (404), and each of said water transporting branching pipes is provided with a number of injection tubes (405) from which water is injected onto the disc surfaces of the annular disc pieces (2011).

28. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that the inner side and/or outer side of the annular disc pieces with filtering pores is adhered with a porous filtering mesh, whose pore size may be varied according to actual needs.

29. The laminated filter with an unpowered automatic cleaning device according to claim 21, characterized in that the hollow filter discs include various annular disc pieces adhered with a porous filtering mesh of different pore size for replacement according to different filtering requirements.

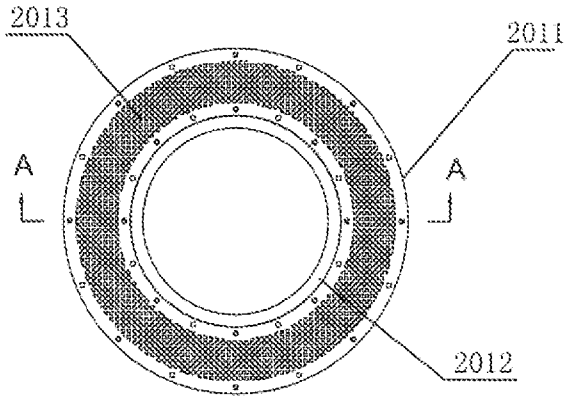


FIG. 1a

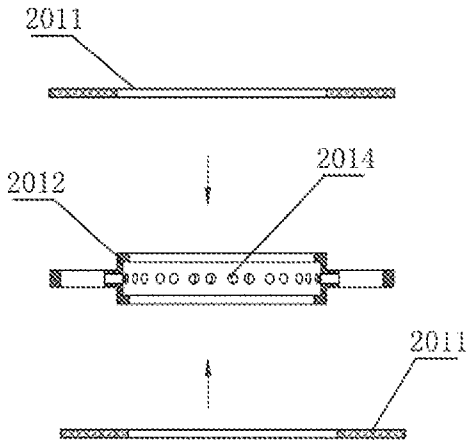


FIG. 1b

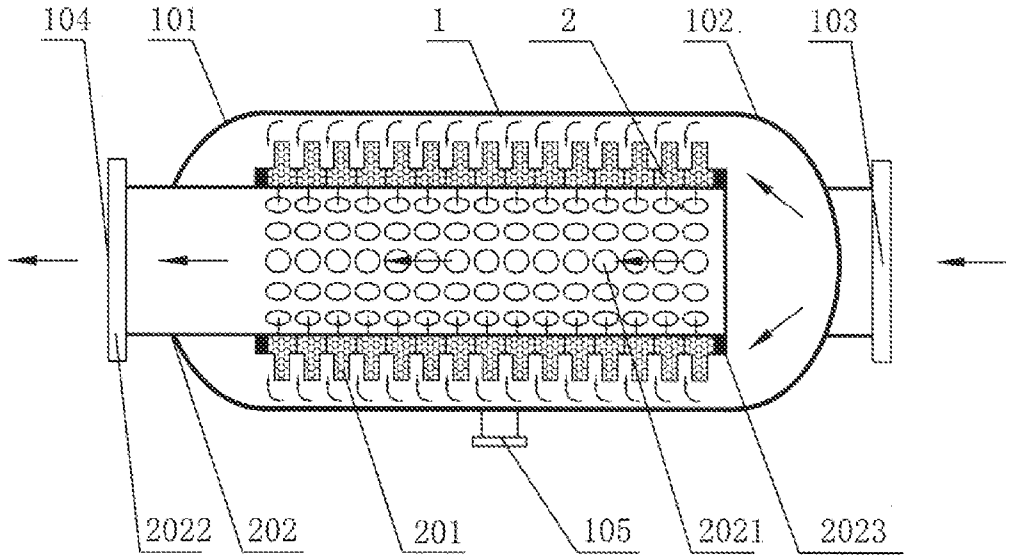


FIG. 2

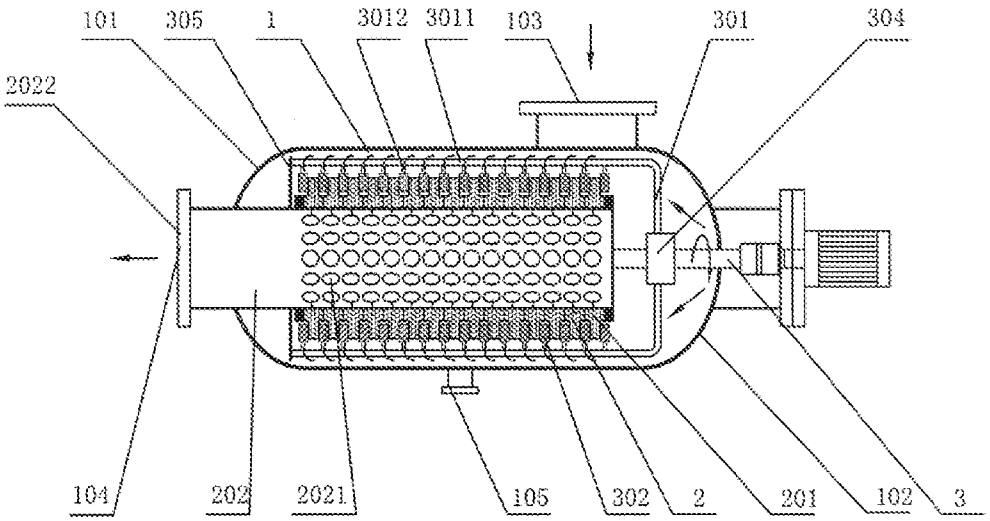

101
305
1
3012
3011
103
301
304
2022
104
202
2021
105
302
2
201
102
3

FIG. 3a

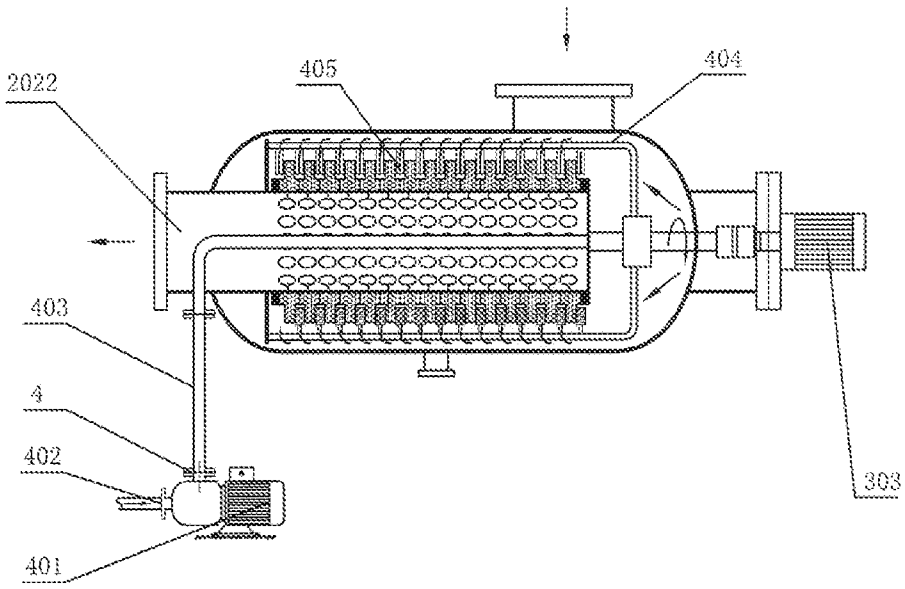
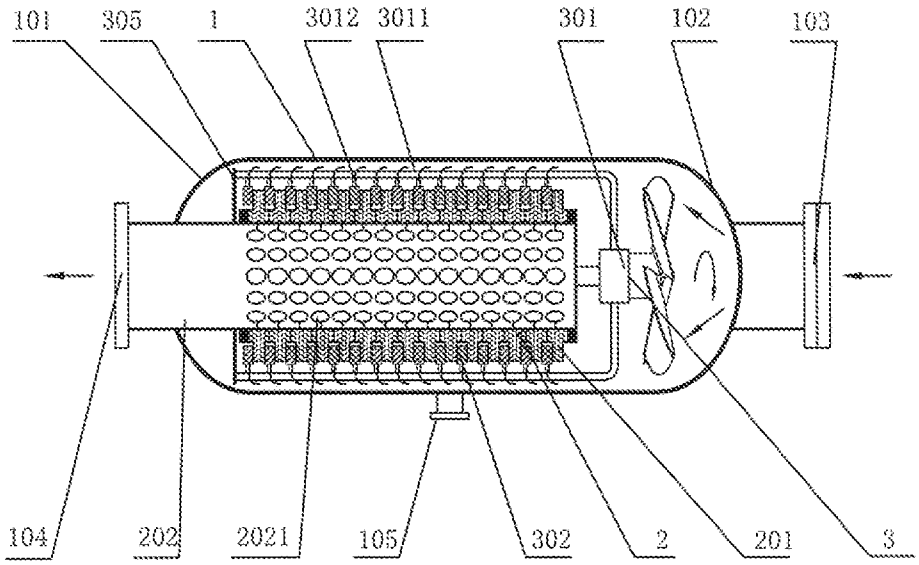

2022
405
404
403
4
402
401
303

FIG. 3b


101
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1
3012
3011
301
102
103
104
202
2021
105
302
2
201
3

FIG. 4a

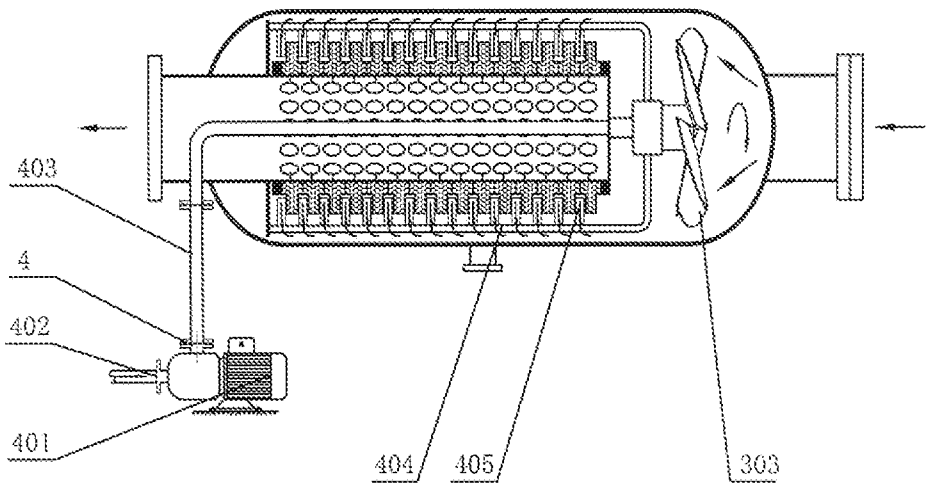
403
4
402
401
404
405
303

FIG. 4b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/078361

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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: B01D

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

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

CNPAT, CNKI, WPI, EPODOC, filter???, disc?, clean+, brush, frame

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP0993853A2 (FILTRA DI PRUNI S & C SNC) 19 Apr. 2000 (19.04.2000) paras. 0022-0030 of the description, abstract, figures 1-5	1-11
A		12-29
X	EP1148925A1 (CUNO INC) 31 Oct. 2001 (31.10.2001) example 3, figures 1-5	1-11
A		12-29
X	EP0284404B1 (PALL CORP) 18 May 1994 (18.05.1994) claims 1-11, figures 1-4	1-7
PX	CN101954215A (FUJIAN NEWLAND ENTECH CO LTD) 26 Jan. 2011 (26.01.2011) claims 1-12, figures 1-3	1-29

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

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

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

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

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 Nov. 2011 (04.11.2011)	**17 Nov. 2011 (17.11.2011)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer XU,Xuefeng Telephone No. (86-10)62084843

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/078361

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN101985072A (FUJIAN NEWLAND ENTECH CO LTD) 16 Mar. 2011 (16.03.2011) claims 1-11, figures 1-2	1-11
PX	CN201823375U (FUJIAN NEWLAND ENTECH CO LTD) 11 May 2011 (11.05.2011) claims 1-12, figures 1-3	1-29
PX	CN201823376U (FUJIAN NEWLAND ENTECH CO LTD) 11 May 2011 (11.05.2011) claims 1-12, figures 1-3	1-29
PX	CN201832471U (FUJIAN NEWLAND ENTECH CO LTD) 18 May 2011 (18.05.2011) claims 1-11, figures 1-2	1-11
PX	CN101961572A (FUJIAN NEWLAND ENTECH CO LTD) 02 Feb. 2011 (02.02.2011) claims 1-12, figures 1-3	1-29

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2011/078361

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		AU771121B2	11.03.2004
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		US7582209B2	01.09.2009
		US2010264077A1	21.10.2010
		EP1148925B1	10.08.2011
		BR0009400B1	17.05.2001
		DE1148925T	04.04.2002
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		GB2202760B	19.06.1991
		US5100551A	31.03.1992

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2011/078361

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		DE3889573G	23.06.1994
		JP6098250B	07.12.1994
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CN101985072A	16.03.2011	NONE	
CN201823375U	11.05.2011	NONE	
CN201823376U	11.05.2011	NONE	
CN201832471U	18.05.2011	NONE	
CN101961572A	02.02.2011	NONE	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/078361

CONTINUATION OF A. CLASSIFICATION OF SUBJECT MATTER

B01D 29/41 (2006.01)i

B01D 29/64 (2006.01)i

B01D 29/66 (2006.01)i