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(54) Title: NOZZLE-BRUSH AUTOMATIC CLEANING FILTER WITH MOTOR REDUCER

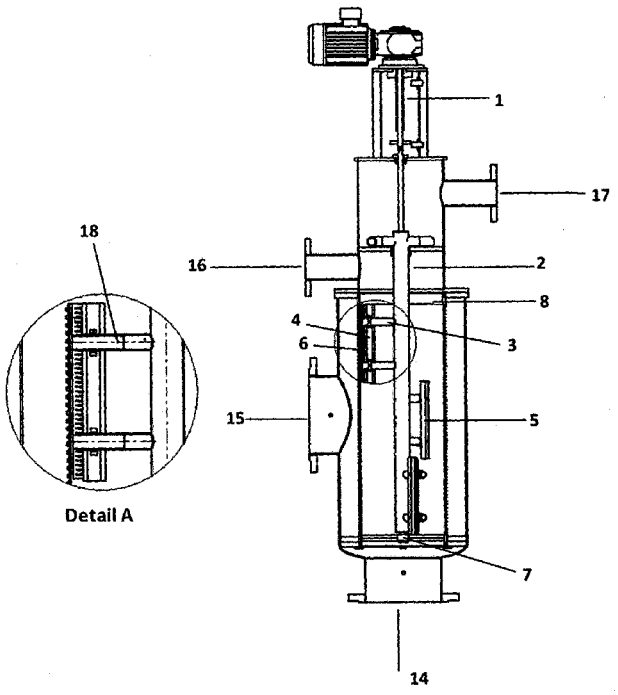

Figure-1

(57) Abstract: The subject matter of the invention is a nozzle-brush automatic cleaning filtration device with motor reducer performing physical cleaning by trapping coarse particles and suspended solid contents in any liquids. These filters perform physical cleaning by trapping coarse particles and suspended solid contents in any liquids.

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DESCRIPTION

NOZZLE-BRUSH AUTOMATIC CLEANING FILTER WITH MOTOR REDUCER

The subject matter of the invention is a liquid filtration device being a "Nozzle-Brush Automatic Cleaning Filter with Motor Reducer". These filters perform physical cleaning by trapping coarse particles and suspended solid contents in any liquid. Its housing material and some internal equipment can be manufactured from metal or plastic based materials (stainless steel, carbon steel, PVC, etc.). Its body has a cylindrical structure. The filter's inlet and outlet pipes have been designed as to have flange connections. The filter can be connected directly to pressurized pipelines by means of these flanges. Due to this feature, it does not require special support and space. It can be mounted in pressurized pipelines having minimum 1 bar and maximum 25 bar.

As it is known, surface waters are intensely used worldwide for quite various purposes. Such areas of usage are irrigation systems, potable and tap water purposes and cooling water. However, surface waters contain also fine particles besides many macro-particles. Such water types require both coarse and fine filtration.

It is impossible to perform both coarse and fine particle filtration by means of the existing automatic cleaning systems. This invention aims to provide the solution for this problem.

In some cases, existing cleaning systems' screens cannot be cleaned thoroughly due to the type of pollutants and/or the water pressure. In such a case, the dirt building up and not cleaned from the internal surface of the filter screen is fully removed by this invention having adjustable revolutions with motor reducer combining brush and nozzles device being the subject matter of the invention.

The water to be filtered has a minimum pressure of 1 bar (usually being 0,5 bars), its flow rate (m^3/s) is very high, and includes pollutants as tree branches, leaves, fishes, frogs, moss, waste, sand, silt, algae as well as suspended solids and fine particles depending on the environment.

KR 2013 0063563-A discloses an automatic cleaning nozzle and brush filter with motor reducer and it comprises of a body, a filter screen, a combined nozzle and brush back-flush device operating on the outer periphery of the filter screen, and a driver with motor reducer incorporated in its structure. There are provided a variety of nozzles in this filtering device each applying a pressurized water spray to the filter, but this arrangement overall fails to conduct an effective cleaning of the filter screens by separately removing fine and coarse particles, and the system provides a complicated arrangement for cleaning of the filter.

In order to filter such waters a type of filter structure providing the features below is required:

- Filter element able to allow high flow rates,
- Manufacture with different filtration levels,
- Create very low head loss,
- Capable to trap both coarse and fine particles easily,
- Structure ensuring removal of trapped particles automatically,
- Perfectly circular surface to ease automatic cleaning of the combined brush and nozzles device to be installed,
- Provide a resistance ensuring that the device will not be deformed when subjected to ΔP load in addition to the pressure and the high flow rate.

Both coarse and fine particles accumulating on the internal surface of the filter screen (8) are discharged through the drainage lines (16 and 17) located on the console group (11) while the automatic cleaning process is taking place. Generally, valves are connected to such drainage lines (16 and 17) and when these valves are opened to the atmosphere, a strong hydraulic current is created towards the drainage outlet. The cleaning process of such filter types consist of two stages:

1st Stage (Brush Cleaning): If a differential pressure (**ΔP**) between the inlet pipeline (14) and the outlet pipeline (15) is detected, the motor (9) actuates the combined brush and nozzles device (12). Thereby, this device performs a vertical and linear displacement creating a helical movement. During this helical movement brushes remove the dirt built up on the internal surface of the filter screen. Afterwards, the exhaust valve on the drainage line (16) opens to atmosphere creating a strong hydraulic current discharging the dirt out of the filter. However, this brush cleaning is only a coarse cleaning process.

2nd Stage (Nozzle Cleaning): The fine cleaning process is performed at 2nd stage, after the coarse cleaning done by brush at the 1st stage. The exhaust valve on the drainage line (16) used for the brush cleaning process is closed and the exhaust valve on the drainage line (17) for the nozzle cleaning process is opened. The opening of this exhaust valve creates a vacuum effect at the internal of the nozzles. Meanwhile, the motor continues to execute the helical movement of the combined

brush and nozzles device (12). This helical movement allows the nozzles to remove the accumulated fine particles from the internal surface of the screen by means of the vacuum suction. The dirt sucked by the nozzles is discharged from the filter through the drainage line (17). During these stages, the filtration process is not interrupted.

By this means, the filter can be cleaned by simply opening and closing the valves without the necessity of any manual disassembling and reassembling. The full automatic performance of the filter is ensured by the electrically controlled drainage valves, which open and close according to the signals received from the ΔP sensors placed at the inlet and outlet of the filter. As the system is fully automatic, the opening and closing of the actuator valves is realized by means of signals from a time relay or a ΔP sensor measuring the pollution level. Depending on the site conditions, combinations based both on time and ΔP can be generated.

As a summary, this filter will be manufactured as an easily assembling device having a robust structure including a perfectly circular stainless steel screen, motor (9) reducer (10) with various power ratios for the combined brush and nozzles device (12) produced from metal and/or plastic materials as well as the cylindrical housing (13). Consequently, this filter will offer simple and fast solutions for large sort of requirements thanks to all these high performance features.

In one broad form, the present invention provides a filtration device including a filter housing having a filter screen located therein, said device further including a combined nozzle and brush back-flush device and a console group with a motor reducer and motor providing rotation of the combined nozzle and brush back-flush device, said device having a functionality to remove dirt from internal surface of the filter screen by way of rotation provided by actuation of the motor,

whereby the device includes a drainage line with an exhaust valve for a coarse cleaning process, and

whereby said combined nozzle and brush back-flush device includes nozzles operated under vacuum created by an exhaust valve on another drainage line.

In a further broad form, the present invention provides a process for filtering water including pollutants with a filtration device, including:

- applying a first stage of coarse cleaning process, once detecting a differential pressure between inlet pipeline and outlet pipeline, by removing dirt built up in the internal surface of the filter screen; in said first stage, the motor actuates the combined brush and nozzles device to perform a vertical and linear displacement creating a helical movement whereby a hydraulic discharge current is created via drainage line, and

- applying a second stage of fine cleaning process by removing fine particles from the internal surface of the filter screen; said second stage including closing of an exhaust valve on the drainage line used for the brush cleaning process of the first

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stage, and opening of an exhaust valve on the drainage line for the nozzle cleaning process whereby opening of said valve on the drainage line creates a vacuum at the internal of the nozzles for discharging the dirt sucked by the said nozzles.

EXPLANATION OF THE FIGURES

The present invention will become more fully understood from the following detailed description of preferred but non-limiting embodiments thereof, described in connection with the accompanying drawings:

Figure-1 Sectional view of the mounted filter

Figure-2 Filter housing

Figure-3 Filter screen

Figure-4 Combined Nozzle and Brush device

Figure-5 Console group with motor reducer

REFERENCE NUMBERS

1. Reducer Shaft
2. Collector Pipe
3. Collector Nozzle
4. Brush Fixing Plate
5. Brush Holder
6. Brush
7. Collector Bearing
8. Filter Screen
9. Motor
10. Reducer
11. Console Group with Motor Reducer
12. Combined Nozzle and Brush Device
13. Filter Housing
14. Inlet Pipeline
15. Outlet Pipeline

16. Drainage Line (for brush cleaning)

17. Drainage Line (for nozzle cleaning)

18. Nozzle

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT(S)

The liquid to be filtered enters to the filter through the inlet pipeline (14). The cylindrical filter screen (8) placed inside the filter performs the filtration of this liquid entering to the filter. The liquid passing through the filter screen (8) gets out via the outlet pipeline (15) and continues its way as a filtered liquid. As this liquid flows through, the filter screen (8) traps the fine and coarse particles inside the liquid described above. Hence, clogging will occur on the internal surface of the filter screen (8) according to the amount of dirtiness in it. Such clogging causes a ΔP value between the inlet and the outlet. Additional different equipment capable to detect the ΔP value is available and can be mounted on the sleeves located on the filter body. According to the design of the filter station and the customer requirements, ΔP or pressure transmitter serves for this purposes. This equipment detecting ΔP sends signals to the motor (9) when the ΔP between the inlet and the outlet has reached a preset value and triggers the cleaning mechanism's operation. Such cleaning process is performed at two stages, namely, brush cleaning and nozzle cleaning.

At the 1st stage, the brush cleaning mode, the motor (9) starts to rotate the reducer shaft (1). At the same time, the drainage outlet (16) for the brush cleaning process is opened. The collector pipe (2) realizes both its cyclical rotation movement and its linear progressing movement and thus performs a helical displacement provided by the motor (9) to the reducer shaft (1). Owing to such helical movement, the brushes sweep off the dirt accumulated on the internal surface of the screen. The coarse dirt removed from the internal surface of the screen by the brushes is discharged from the filter due to the impact of a strong current created by opening the exhaust valve at the drainage outlet (16) open to the atmosphere.

At the 2nd stage, fine particles not being removed from the internal surface of the screen by the brushes, will be completely removed during the nozzle cleaning process. The nozzle cleaning process starts after the ΔP has been dropped to some level by the brush cleaning. The combined nozzle and brush back-flush device (12) performs its helical movement while the nozzles are scanning and cleaning the whole screen surface. Meanwhile, the exhaust valve at the drainage outlet (16) for the brush cleaning process is closed and the second exhaust valve at the drainage outlet (17) for the nozzle cleaning process is opened. Afterwards, the dirt passes through the nozzles (3) sucked from the internal surface of the screen through the collector pipe (2) and thus allows the dirt to be discharged from the filter through the second exhaust drainage outlet (17) open to the atmosphere.

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When the cleaning procedure is completed, the ΔP between the filter inlet and outlet drops back to its initial value, a signal is sent to the motor and to the exhaust valve (17) to be closed automatically. The system continuous to perform its ordinary operations (filtration).

During these stages execution, the filtration process is not interrupted.

STRUCTURE OF THE INVENTION

Basically, the invention preferably consists of four major groups:

1. Filter Housing (13)

2. Filter Screen (8)

3. Combined Nozzle and Brush Device (12)

4. Console Group with Motor Reducer (11)

FILTER HOUSING

The filter housing (13) is a structure manufactured either from metal or plastic based materials (stainless steel, carbon steel, etc.) having a fully cylindrical shape, being its inlet and outlet connections are flanged and equipped with sleeves for extra equipment to be connected.

The filter housing (13) consists of a main pipe including inlet and outlet pipes welded to it. The inlet and outlet pipes are flanged and therefore can be easily mounted to pressurized or non-pressurized pipelines. A flange fixing the console group (11) with motor reducer is located on the upper part of the body.

The filter housing (13) is designed to resist to a pressure of 10 bars or 16 bars, depending on the specific requirement. Also, the device can be manufactured to suit temperatures of 60°C or 90°C.

FILTER SCREEN

The filter screen (8) is a structure performing the filtration function, manufactured from stainless steel, having a full cylindrical form and capable to offer various filtration ratios.

The diameter and height of the filter screen is specified as to provide the filtration surface, which is calculated on the basis of the filter inlet and outlet diameters and the flow rate quantity. Afterwards, the manufactured screen (8) is placed into the filter housing (13).

COMBINED NOZZLE AND BRUSH BACK-FLUSH DEVICE

The combined nozzle and brush back-flush device (12) is a group consisting of several parts as a stainless steel collector pipe (2), stainless steel collector nozzles (3), stainless steel brush fixing plates (4), and brushes (6) manufactured from metal or plastic based materials, and brush holders (5) and nozzles (18). Upon placing the filter screen (8) into the filter housing (13), this device is mounted into the screen and thus it is centered with the collector bearing (7). It has the functionality to remove the dirt from internal surface of the filter screen (8) by rotating (cyclical and linear movement) due to the actuation of the motor.

CONSOLE GROUP WITH MOTOR REDUCER

The console group (11) with motor reducer is a console consisting of several parts as a motor (9)-reducer (10) providing the rotation to the combined nozzle and brush back-flush device (12), housing connection flanges, drainage pipes, flanged parts and other parts. Upon placing the internal parts into the filter housing (13), this console group (11) with motor reducer is placed onto the housing and connected to it.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as, an acknowledgement or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

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The claims defining the invention are as follows:

1. A filtration device including a filter housing having a filter screen located therein, said device further including a combined nozzle and brush back-flush device and a console group with a motor reducer and motor providing rotation of the combined nozzle and brush back-flush device, said device having a functionality to remove dirt from internal surface of the filter screen by way of rotation provided by actuation of the motor,

whereby the device includes a drainage line with an exhaust valve for a coarse cleaning process, and

whereby said combined nozzle and brush back-flush device includes nozzles operated under vacuum created by an exhaust valve on another drainage line.

2. A filtration device according to claim 1 wherein said filter housing has a cylindrical structure made of a metal or plastic material.

3. A filtration device according to claims 1 or 2 wherein said filter screen is having a fully cylindrical structure made of stainless steel.

4. A filtration device according to any one of claims 1 to 3 wherein said combined nozzle and brush back-flush device includes a collector pipe, collector nozzles, brush fixing plates, brushes, brush holders and nozzles incorporated therein.

5. A filtration device according to any one of claims 1 to 4 wherein said combined nozzle and brush back-flush device is placed into the filter screen and it is centered with a collector bearing.

6. A process for filtrating water including pollutants with a filtration device according to any one of claims 1 to 5, including:

- applying a first stage of coarse cleaning process, once detecting a differential pressure between inlet pipeline and outlet pipeline, by removing dirt built up in the internal surface of the filter screen; in said first stage, the motor actuates the combined brush and nozzles device to perform a vertical and linear displacement creating a helical movement whereby a hydraulic discharge current is created via drainage line, and

- applying a second stage of fine cleaning process by removing fine particles from the internal surface of the filter screen; said second stage including closing of an exhaust valve on the drainage line used for the brush cleaning process of the first stage, and opening of an exhaust valve on the drainage line for the nozzle

cleaning process whereby opening of said valve on the drainage line creates a vacuum at the internal of the nozzles for discharging the dirt sucked by the said nozzles.

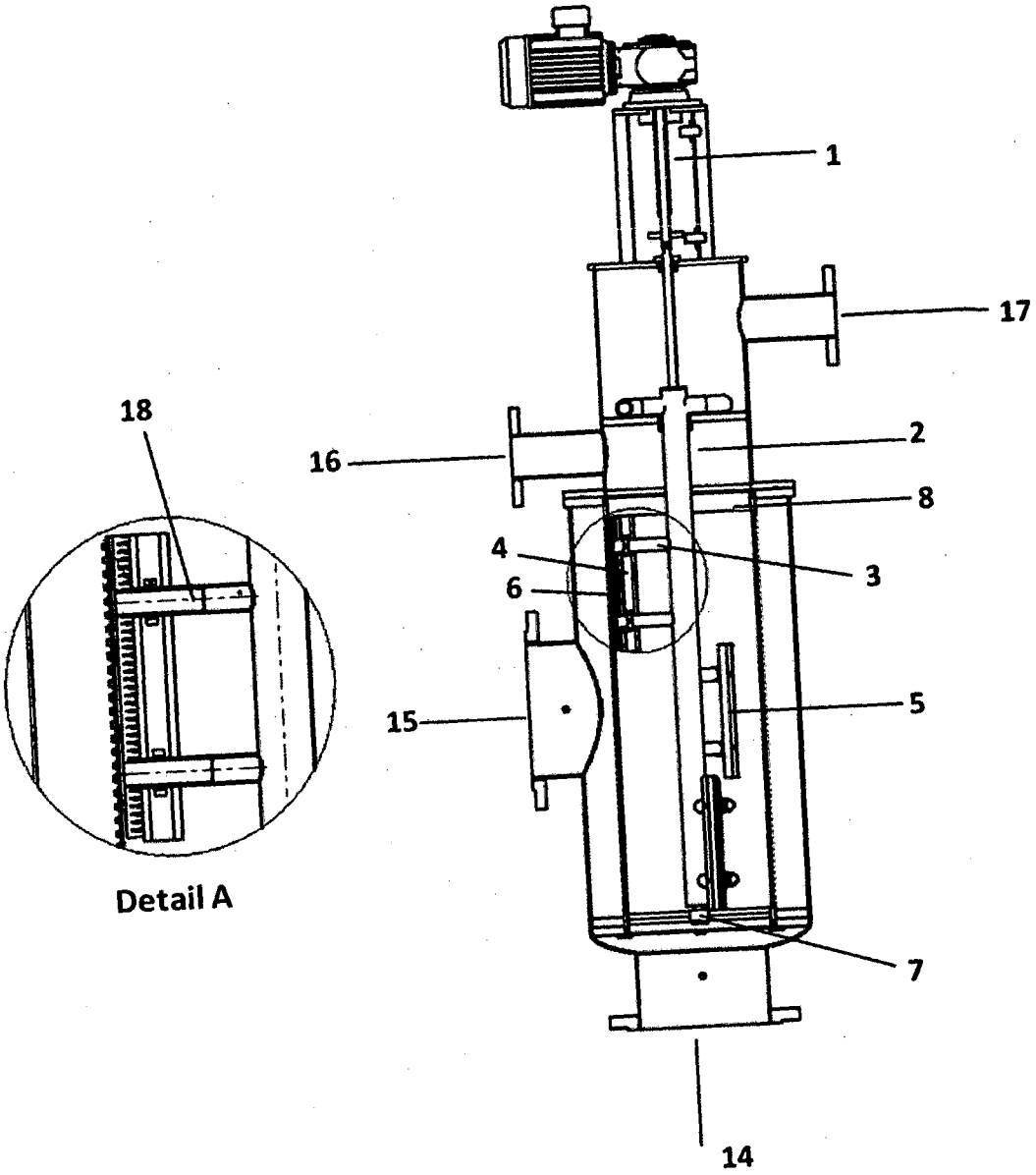

Figure-1

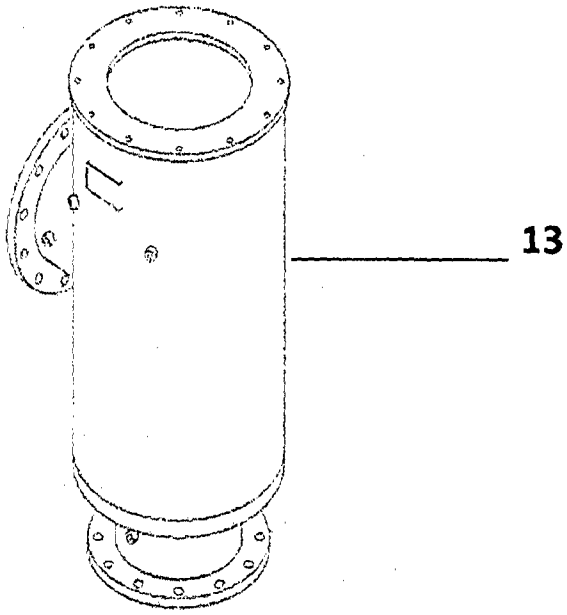

Figure-2

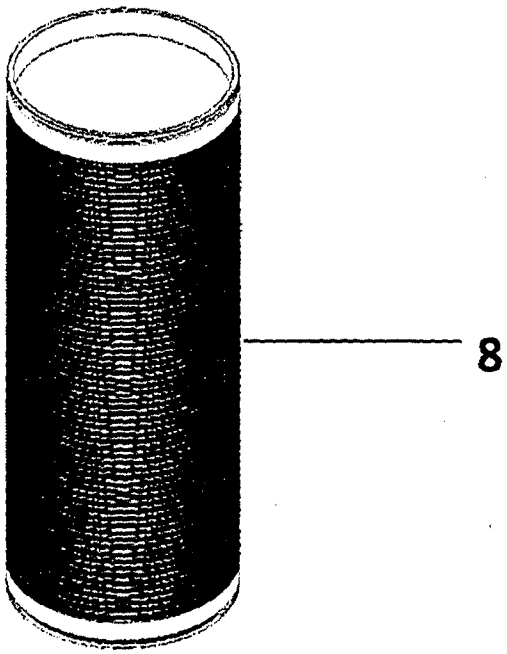

Figure-3

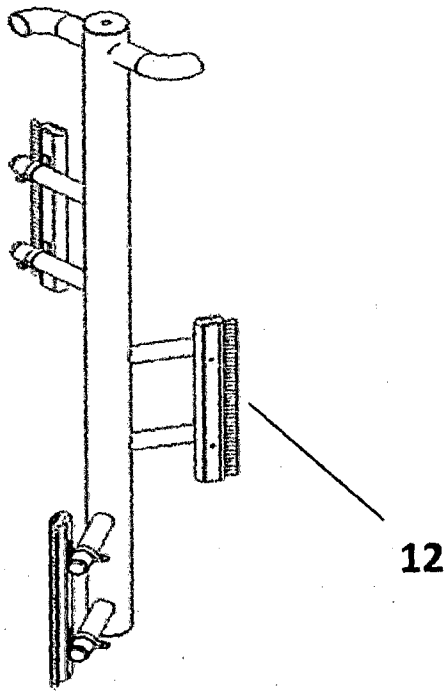

Figure-4

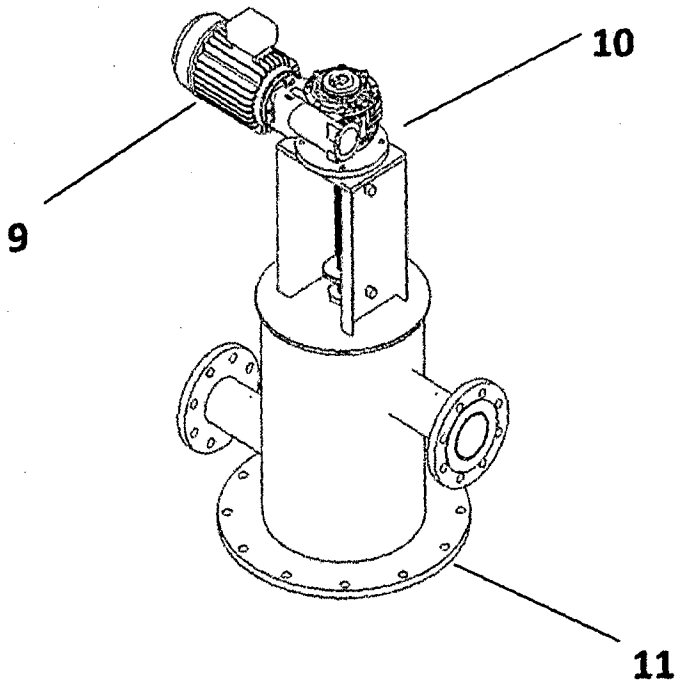

Figure-5