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(54) Filter with rotary washing arms

(57) A filter comprises a housing 11 with inlet 15A and outlet 15B at opposite ends, enclosing a fixed pervious screen 25, both housing and screen being bodies of revolution about axis A. The housing tapers towards outlet 15B, where the annular space between the housing and screen opens into a solids-collecting zone 28. Inside the screen is a rotary assembly comprising two nozzle tubes directing a proportion of filtered liquid, recycled by external pump 45 from the space inside the screen, towards the screen so as to flush solids retained on its exterior progressively along the screen to zone 28. A fraction of the liquid from pump 45 is injected through three tangential nozzles into zone 28 to create a rotary flow and flush the solids towards tangential outlet 30. The assembly of nozzle tubes is rotated by the main flow of filtered liquid acting on inclined vanes 50.

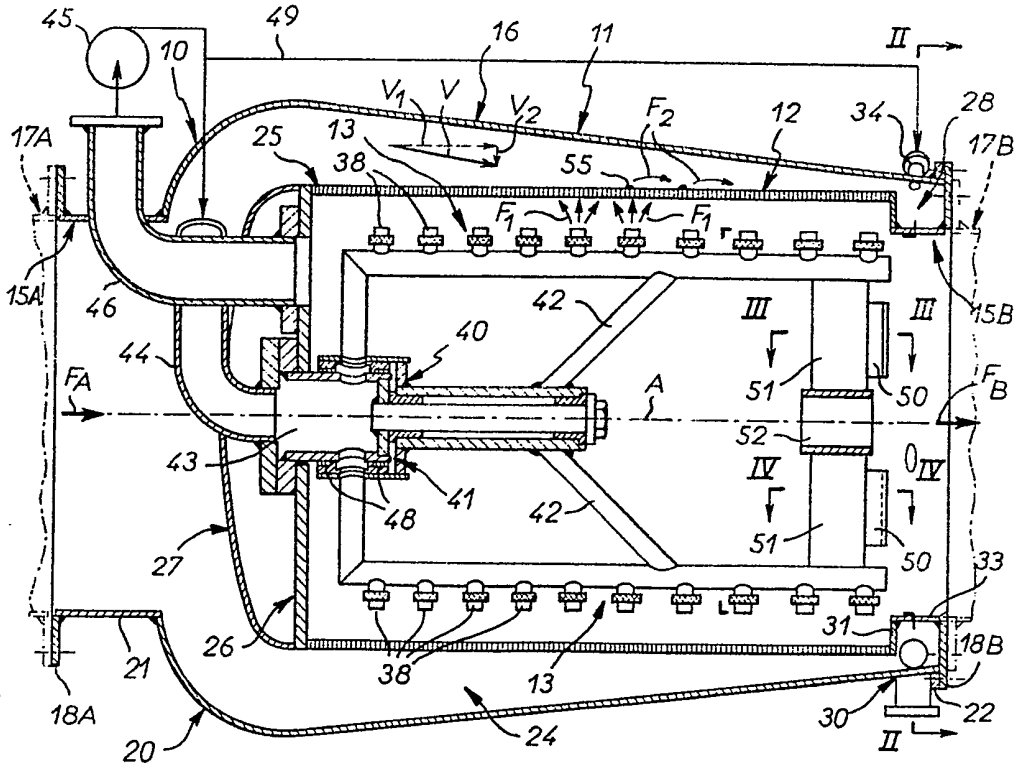

FIG.1

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FIG.1

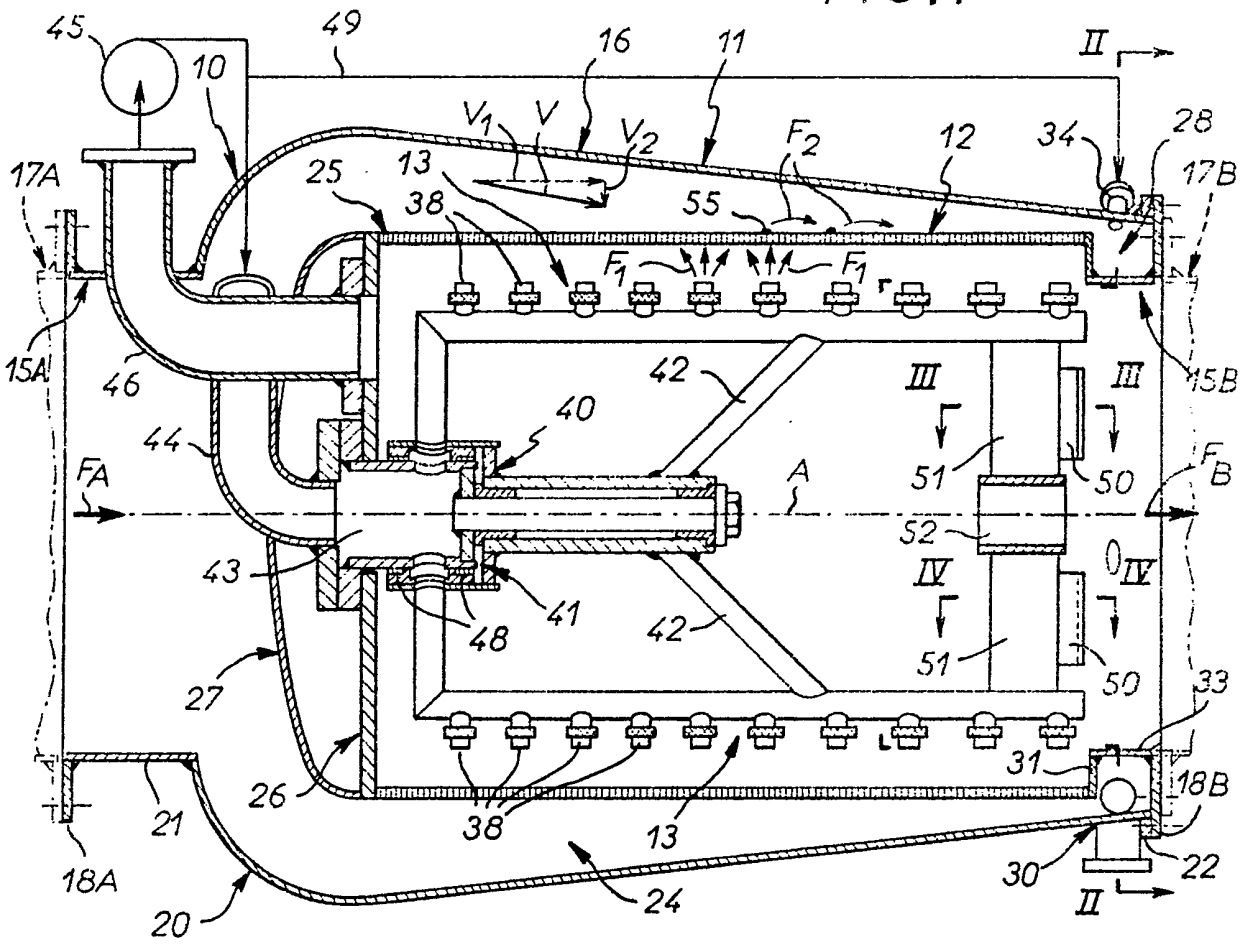

FIG.2

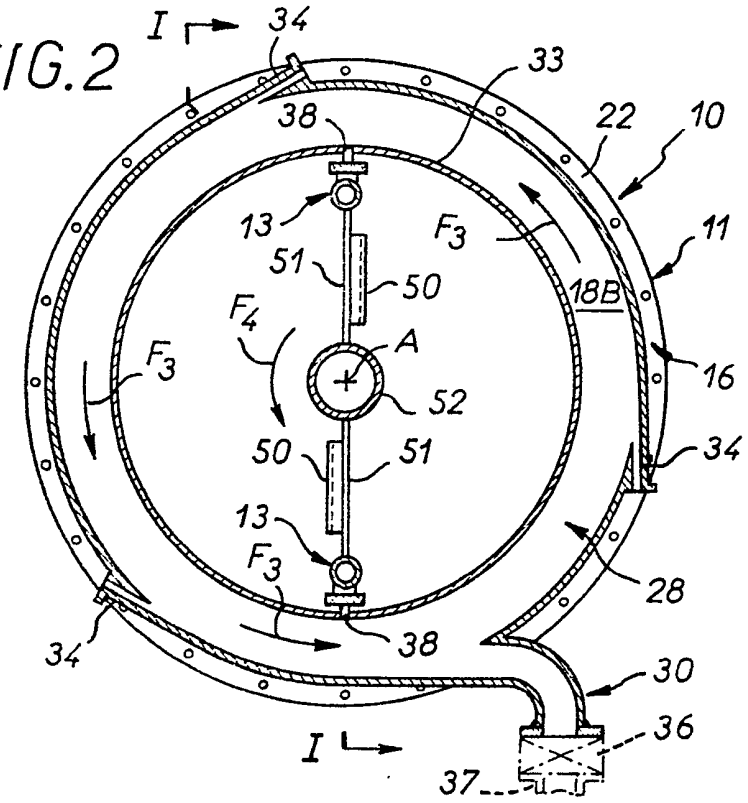

FIG.3

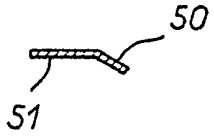

FIG.4

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Filter with rotating wash manifold

The present invention is generally concerned with filters comprising a body which has an inlet and an outlet and the side wall at least of which is in the shape of a body of revolution, a fixed screen coaxial with and inside the body and whose side wall at least is a filter wall disposed between the inlet and the outlet of the body and is also in the shape of a body of revolution, and at least one washing ramp extending along a generatrix of the screen and rotatably mounted inside the screen.

Filters of this type are designed to be inserted axially under pressure into a pipe to eliminate impurities, detritus and other debris of small and medium size that may be carried by the flow in the pipe.

One problem for designers of filters of this type is the need to remove debris retained by the filter wall of the screen to prevent the latter clogging.

If no specific arrangements are made otherwise, the water jets from the washing ramp merely lift deposited debris from the filter wall temporarily before it returns thereto.

In some known designs the filter wall of the screen is generally cylindrical and the body is periodically flushed to discharge debris on it.

Because the debris is distributed throughout the body, the effectiveness of any such flushing is limited, however.

In other known designs the filter wall of the screen is generally frustoconical and the flushing is applied to an evacuation pipe opening axially in the vicinity of its smaller diameter end.

As previously, this flushing is of limited effectiveness, only some of the retained debris reaching

the pipe provided for evacuating it.

An object of the present invention is a filter which has the advantage of enabling these problems to be circumvented and which provides other advantages.

The present invention provides a filter comprising a body having an inlet and an outlet and whose side wall at least is in the shape of a body of revolution, a fixed screen disposed coaxially inside said body and whose side wall at least is a filter wall disposed between an inlet and an outlet of said body and is also in the shape of a body of revolution, and at least one wash manifold rotatably mounted in said screen extending along a generatrix thereof, wherein over part at least of its length the side wall of the body is generally oblique to the side wall of the screen, converging towards the latter in the direction from the inlet of the body to its outlet, and there is provided at the same end of the side wall of the screen as the outlet of the body an annular collection space adapted to receive debris conveyed by the flow to be treated and connected to an evacuation pipe.

For reasons of simplicity, the side wall of the body is generally frustoconical and that of the screen is generally cylindrical, for example.

Because the side wall of the body is obliquely disposed to that of the screen, the velocity vector in the annular space of the incoming flow to be treated is itself oblique to the side wall of the screen with the result that this velocity vector has a component parallel to the axis of the system which distributes the flow over all of the side wall of the screen and conveys debris in the flow towards the collection space and a transverse component causing the flow to pass through the side wall of the screen.

In other words, because of this oblique

disposition, the treated flow is guided optimally along all of the side wall of the screen and is distributed optimally along the latter to pass through it.

It is preferably designed so that, given the flow cross-section provided, the modulus of the flow vector of the incoming flow to be treated remains substantially constant along all of the side wall of the screen.

Due only to this velocity vector, a significant proportion of the entrained debris is systematically conveyed towards the collection space provided at the end of the side wall of the screen.

On each rotation of the wash manifold the remaining debris deposited on the side wall of the screen is removed from the side wall of the screen by the wash water and returned into suspension in the incoming flow, as it were, and is then entrained a little further downstream by the flow until it is again deposited on the side wall of the screen.

The debris therefore eventually reaches the collection space provided at the end of the side wall of the screen.

Continuous drainage at a very low flowrate and/or periodic flushing at a high flowrate are sufficient to evacuate the debris reaching the collection space.

To improve the efficiency of this process, at least one nozzle is preferably provided discharging obliquely into the collection space to induce therein rotation about the axis of the system.

The debris present in the collection space is therefore systematically kept in motion, without being able to collect and settle in any part thereof.

At least one vane at least in part oblique to the axis of the system is preferably fastened to the wash manifold to rotate the manifold.

Rotation is usually obtained by means of jets

issuing obliquely from the wash manifold itself.

Apart from the fact that such jets consume energy, the rotation torque they are capable of generating is still relatively weak and the resulting rotation speed is usually difficult to control.

The vane(s), which may be sufficient on their own or used in conjunction with such jets, advantageously make it possible to exploit the kinetic energy of the outgoing flow already treated to achieve the required rotation. Their angle of incidence relative to the velocity vector of the flow and their surface area advantageously allow convenient control of the resulting rotation speed.

They have the further advantage of yielding a maximum torque on starting up.

In brief, a filter in accordance with the invention is advantageously a compact counterflow washed filter using a wash manifold whose output is advantageously re-injected into the treated flow so that washing requires no aspiration or suction system with the result that its construction can with advantage be relatively crude and therefore economical; nor does the filter require any motor to drive the wash manifold and so is not subject to any wear; because the wash manifold is on the same side as the treated outgoing flow, its is not subject to jamming and therefore requires relatively little maintenance.

The features and advantages of the invention will emerge from the following description given by way of example only with reference to the appended diagrammatic drawings in which:

- figure 1 is a view in axial cross-section of a filter in accordance with the invention;

- figure 2 is a view of it in transverse cross-section on the line II-II in figure 1;

- figures 3 and 4 are partial views of it in partial cross-section parallel to its axis on the respective lines III-III and IV-IV in figure 1.

Referring to the figures, a filter 10 designed for treating any kind of flow, any kind of flow of water, for example, comprises a fixed body 11, a screen 12 inside the body 11 and at least one wash manifold 13 rotatably mounted inside the screen 12. These arrangements are known in themselves.

The body 11 has an inlet 15A and an outlet 15B and its side wall 16 at least is in the shape of a body of revolution.

The axis A of this body of revolution is shown by a chain-dotted line in figure 1 and its position is shown in figure 2.

The filter 10 is designed to be inserted axially under pressure between two sections 17A, 17B of a pipe, as schematically represented in chain-dotted line in figure 1, its inlet 15A and its outlet 15B are axial, coaxial with the axis A of the side wall 16 and surrounded by respective flanges 18A, 18B transverse to the axis A for making the appropriate connections.

The body 11 has at the same end as its inlet 15A a back 20 of toroidal shape joining the side wall 16 to a section of pipe 21 at the end of which is the respective transverse flange 18A.

The flange 18B at the same end as the outlet 15B is directly at the end of the side wall 16, being laid against and fastened to a counter-flange 22 mounted on the outside of the side wall 16.

The fixed screen 12 is disposed coaxially inside the body 11, defining an annular space 24 with the side wall 16 thereof. At least its side wall 25, which is a filter wall inserted between the inlet 15A and the outlet 15B of the body 11, is also in the shape of a body of

revolution about the axis A.

At the same end as the inlet 15A of the body 11, the screen 12 is closed by a back 26 with which is associated a cap 27 shaped for improved guidance of the incoming flow to be treated. It is open at the same end as the outlet 15B of the body 11.

Only the side wall 25 is a filter wall.

In a manner that is known in itself and not relevant to the present invention, so that there is no need to describe it in detail here, the filter wall may be made up of spaced bars parallel to the axis A joined transversely together by spaced annular cross members defining a grid with the bars.

Over part at least of its length the side wall 16 of the body 11 is generally oblique to the side wall 25 of the screen 12, converging towards the latter in the direction from the inlet 15A of the body 11 to its outlet 15B. At the same end as the outlet 15B of the body 11, at the end of the side wall 25 of the screen 12, there is a collection space 28 adapted to receive debris entrained by the flow to be treated and connected to an evacuation pipe 30.

The side wall 16 of the body 11 is generally frustoconical and the side wall 25 of the screen 12 is generally cylindrical.

The collection space 28 extends radially from the screen 12 towards the axis A.

The collection space 28 is delimited by the side wall 16 and the flange 18B of the body 11, by an annular flange 31 fastened to the respective end of the screen 12 and, like the flange 18B, disposed transversely to the axis A, and by a cylindrical member 33 joining the annular flange 31 to the flange 18B.

At least one nozzle 34 discharges obliquely into the resulting collection space 20A. The nozzle injects

water to induce rotation about the axis A.

In this embodiment three nozzles 34 are equi-angularly distributed around the axis A and all three are substantially tangential to a common circumference of the side wall 16 of the body 11.

The evacuation pipe 30 is joined obliquely to the collection space 28, in the opposite direction to the nozzles 34.

It is tangential to the side wall 16 of the body 11.

As schematically represented in chain-dotted line in figure 2, the evacuation pipe 30 is adapted to be connected under the control of a valve 36 to a pipe 37 connecting it to a discharge or to a drain.

In this embodiment two identical wash manifolds 13 are provided at diametrally opposed positions.

Each wash manifold 13 extends along a generatrix of the side wall 25 of the screen 12, at a distance therefrom.

It carries spaced nozzles 38.

The nozzles are flat and parallel to the generatrix along which they extend.

The wash manifolds 13 extend like the arms of a candelabrum from a common hub 40 by which they are mounted to rotate on a hollow shaft 41 feeding water to them and to which each is connected by a crossmember or stay 42.

The hollow shaft 41 passes axially through the back 26 of the screen, which carries it, and defines in it a chamber 43 connected by a pipe 44 to the discharge side of a pump 45 whose suction side is connected by a pipe 46 to the interior of the screen 12 and which feeds the wash manifolds 13 via rotary seals 48.

The nozzles 34 are also connected to the discharge side of the pump 45 by a pipe 49 which is schematically

represented in figure 1 by a single line.

To rotate the wash manifolds 13 at least one vane 50 at least partly oblique to the axis A of the system is fastened to each wash manifold 13.

In this embodiment two vanes 50 are provided, one for each wash manifold 13, near the end of the wash manifold 13 and each carried by a radial arm 51 fastened to the respective wash manifold 13.

The arms 51 extend radially from the wash manifolds 13 to a tube section 52 centred on the axis A of the system, common to the two arms 51 and providing access to the hub 40 carrying the wash manifolds 13 for mounting and for demounting them if necessary.

The arms 51 are axially elongated flanges.

The vanes 50 that they carry are in one piece with them, each being simply formed by an oblique lip along one radial edge.

In this embodiment this is the trailing edge but it could equally well be the leading edge.

The vanes 50 extend circularly in the same sense.

The flow to be treated enters the body 11 under pressure through its inlet 15A, as diagrammatically represented by the arrow FA in figure 1.

It then enters the annular space 24 between the body 11 and the screen 12.

Its velocity vector V in this annular space 24 is diagrammatically represented in figure 1.

Because the side wall 16 of the body 11 is oblique to the side wall 25 of the screen 12 the velocity vector 3 is oblique to the latter.

It therefore has a component V1 parallel to the axis A and a component V2 transverse to the axis A.

Because of the component V1 the incoming flow travels along the side wall 25 of the screen 12.

Because of the component V2 it passes through the

side wall 25.

Debris 25 entrained by the incoming flow to be treated is retained by the screen 12, as diagrammatically shown in figure 1.

The jets from the nozzles 38 temporarily detach the debris from the side wall 25 of the screen 12 each time that a wash manifold 13 passes across it, as diagrammatically represented in figure 1 by arrows F1.

Returned to the incoming flow, the debris is progressively entrained by the latter towards the collection space 28, in successive steps diagrammatically represented by the arrows F2 in figure 1.

Because of the jets from the nozzles 34, debris in the collection space 28 is caused to rotate continuously about the axis A, as diagrammatically represented by the arrows F3 in figure 2.

It is therefore sufficient to open the valve 36 periodically to evacuate the debris through the pipe 30.

This flushing may be controlled by a clock, for example.

After passing through the side wall 25 of the screen 12 the treated flow leaves the body 11 through its outlet 15B as diagrammatically represented by the arrow FB in figure 1.

The thrust exerted in the axial direction on the vanes 50 by the treated outgoing flow rotates the wash manifolds 13 in a direction opposite that in which the vanes 50 extend, as diagrammatically represented by the arrow F4 in figure 2.

Of course, the present invention is not limited to the embodiment described and shown but encompasses any variant execution thereof.

Specifically, the filter wall of the screen may be implemented differently from that specifically described.

Although the filter is shown as if it were horizontal, this is not necessarily always the case.

CLAIMS

1. Filter comprising a body having an inlet and an outlet and whose side wall at least is in the shape of a body of revolution, a fixed screen disposed coaxially inside said body and whose side wall at least is a filter wall disposed between an inlet and an outlet of said body and is also in the shape of a body of revolution, and at least one wash manifold rotatably mounted in said screen extending along a generatrix thereof, wherein over part at least of its length the side wall of the body is generally oblique to the side wall of the screen, converging towards the latter in the direction from the inlet of the body to its outlet, and there is provided at the same end of the side wall of the screen as the outlet of the body an annular collection space adapted to receive debris conveyed by the flow to be treated and connected to an evacuation pipe.

2. Filter according to claim 1 wherein at least one nozzle discharges obliquely into said collection space to induce therein rotation about the filter axis.

3. Filter according to claim 2 wherein the evacuation pipe is joined obliquely to the collection space in the opposite sense to the nozzle or nozzles discharging thereinto.

4. Filter according to any one of claims 1 to 3 wherein the collection space extends radially from the screen towards the filter axis.

5. Filter according to any one of claims 1 to 4 wherein at least one vane fastened to said wash manifold and at least in part oblique to the filter axis is associated with the or each wash manifold to rotate it.

6. Filter according to claim 5 wherein said vane is in the vicinity of the end of the wash manifold and is carried by a radial arm fastened to the latter.

7. Filter according to claim 6 wherein the arm

carrying said vane comprises an axially elongate flange and said vane is in one piece with said arm, constituting an oblique lip along one radial edge thereof.

8. Filter according to claim 6 or claim 7 wherein two wash manifolds are provided at diametrally opposed positions and the arms which carry the respective vanes each extend radially from the respective wash manifold to a tube section centred on the filter axis, common to them and providing access to a hub carrying the wash manifolds.

9. Filter according to any one of claims 1 to 8 wherein the side wall of the body is generally frustoconical and that of the screen is generally cylindrical.

10. Filter according to any one of claims 1 to 9 wherein the inlet and the outlet of the body are axial.

11. Filter substantially as hereinbefore described with reference to the accompanying drawing.

Patents Act 1977

Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9210714.3

Relevant Technical fields

(i) UK Cl (Edition K) B1D (DNCH, DNCL, DNPB, DNPX, DQAA)

(ii) Int CL (Edition 5) B01D (29/62, 29/68, 29/94)

Search Examiner

R T HAINES

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

7 JULY 1992

Documents considered relevant following a search in respect of claims 1-11

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 2162081 A (DOWTY GROUP SERVICES)	1-4,9,10
Y	GB 1375210 (SIEMENS)	1,10
Y	GB 1343696 (TAPROGGE)	1,2,3,9, 10
Y	GB 1231874 (SIEMENS)	1,2,3,4, 10
Y	US 4297209 (DE VISSER)	1-4,9,10

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

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P: Document published on or after the declared priority date but before the filing date of the present application.

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