(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 078 792 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.07.2009 Bulletin 2009/29

(51) Int Cl.:
E03F 5/22 *(2006.01)*

(21) Application number: **09150504.0**

(22) Date of filing: **14.01.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA RS

(30) Priority: **14.01.2008 FI 20085028**

(71) Applicant: **Oy KWH Pipe AB**
65101 Vaasa (FI)

(72) Inventors:
- **Hägg, Jan**
  66590 Petsmo (FI)
- **Jutila, Teemu**
  65100 Vaasa (FI)
- **Sillanpää, Ari**
  04200 Kerava (FI)

(74) Representative: **Sundman, Patrik Christoffer**
Seppo Laine Oy
Itämerenkatu 3 B
00180 Helsinki (FI)

(54) Method and device for flushing a pump

(57) A method of flushing the housing of a drain pump (30) which is connected to the process tank of a batch purification unit. According to the method, liquid is led through the housing of the pump in order to remove the solid matter which is accumulated in it. According to the invention, aqueous suspension is pumped by a drain pump (30) into the flushing tank (31) and this pumped aqueous suspension is used to flush the housing of the drain pump, in which case the volume of the aqueous suspension to be pumped into the tank is at least as great as the volume of the housing of the drain pump. It is possible to flush the pump at required intervals and the solid matter which has accumulated inside the pump can thereby be efficiently removed, which renders it possible to avoid the solid matter from migrating into the purified water.

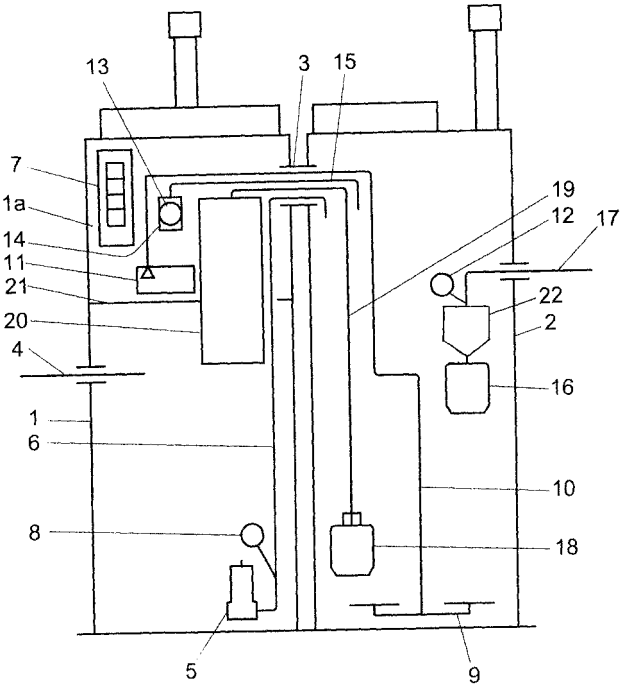

Fig. 1

EP 2 078 792 A1

Description

[0001] The present invention relates to a method of cleaning the housing of a pump, especially a drain pump of a household water batch purification unit, according to the preamble of Claim 1.

[0002] According to such a method, liquid is led through the pump housing in order to remove the solid matter that accumulates in the housing.

[0003] The present invention also relates to a pump arrangement according to the preamble of Claim 9.

[0004] The pumps which are used in batch purification units operate in environments comprising liquid and solid matter. Solid matter easily accumulates in particular in the pump housing, which may be detrimental to the operation of the unit, and usually there is no desire to carry the solid matter forward from the pump. This is the case when, for instance, water which has been purified in the batch purification unit is removed from the unit. When the pump, in which solid matter has been accumulated, is started up, it pumps out this solid matter, too. When the quantities of liquid which are thus expelled are small, this solid matter remaining inside the pump increases significantly the amount of impurities.

[0005] In order to avoid these problems, solutions which employ compressed air have been developed for such pumps. These are described for instance in EP patent specification 1 566 498 and DE utility model 20 105 661. In EP patent specification 1 566 598, the solid matter which has accumulated in the pipeline is removed from the piping by pumping it by means of compressed air back to the waste water separation chamber.

[0006] Publications JP 2004351400 and JP 20001271782 describe pumps with which it is possible to continuously separate water from a sludge which comprises solid matter. However, these solutions are expensive, complicated and difficult to apply to batch purification units.

[0007] The purpose of the present invention is to eliminate problems associated with the known technology and to generate a completely new solution especially for cleaning solid matter from the drain pump of a batch purification unit during the operation.

[0008] The present invention is based on the principle that the housing of the drain pump is flushed with an aqueous suspension which is led through the housing and which comes from a flushing tank, which tank operates as a buffer.

[0009] In this case, before the flushing, the flushing tank is filled by using the drain pump to pump an aqueous suspension into that tank, in order to simultaneously remove from the pump housing at least part of the solid matter inside that housing. Most suitably, the volume of the aqueous suspension to be pumped into the tank is at least as great as, preferably greater than, the volume of the housing of the drain pump.

[0010] The present invention also creates an arrangement of the drain pump for a batch purification unit, which arrangement comprises a pump with an outlet pipe and which is connected to the process tank of the batch purification unit, whereby it possible to remove the aqueous suspension, which is generated in the process tank, from the batch purification unit through the outlet pipe of the pump. According to the present invention, a flushing tank is arranged above the pump, in vertical direction, and it comprises an outlet and an inlet, the inlet being connected to the outlet of the pump. The tank acts as a buffer for the draining and its volume is at least as great as the volume of the draining pump, in which case it is possible to pump, through the outlet of the pump and the inlet of the tank, a volume of liquid which is equivalent to the volume of the entire pump housing.

[0011] More specifically, the method according to the present invention is mainly characterized by what is stated in the characterization part of Claim 1.

[0012] The pump arrangement according to the present invention is, in turn, characterized by what is stated in the characterization part of Claim 9.

[0013] Considerable advantages are obtained by means of the present invention. Accordingly, the solution presented here makes it possible to flush the pump at required intervals. The solid matter remaining inside the pump can be removed efficiently, in which case it is possible to avoid solid matter from migrating into the purified water.

[0014] In the following, the present invention will be examined more closely with the help of a detailed description with reference to the accompanying drawings.

Figure 1 shows the principle structure, viewed from the side, of a waste water purification unit which operates using the batch principle;

Figures 2a and 2b show the structure of a pump arrangement which is equipped with a flushing tank, where Figure 2a is a perspective drawing of the solution, and Figure 2b, a partial cross-section of the solution viewed from the side.

[0015] As seen from above, in the solution according to the present invention, the housing of the drain pump of a batch purification unit is cleaned by regular backflushing. By flushing, it is possible to ensure that detrimental quantities of solid matter do not accumulate in the pump, which matter would be removed along with the liquid when the pump is started.

[0016] The action described above can be carried out once or it can be repeated several times, until the pump housing is essentially cleaned of solid matter. After that, it is possible to remove water from the batch purification unit through the flushing tank without any solid matter from the housing of the pump migrating along with the reject.

[0017] It is possible to flush the pump regularly during its operation, in which case the suitable flushing interval varies according to the utilization rate. In practice, it is enough to flush the pump of a batch purification unit 1-5

times in 24 hours, or more infrequently.

[0018] The flushing tank, which most suitably is placed above the pump, is filled in pulses until it is almost full in such a way that solid matter, too, which is in the pump housing comes to the flushing vessel, after which the liquid/solid matter mixture is allowed to run back, under gravity, through the pump, thus flushing the pump housing.

[0019] The flushing is carried out when necessary. Generally, the length of the pumping pulses is approximately 0.1-20 seconds, preferably approximately 0.5-10 seconds, more preferably approximately 1-3 seconds. The pulse length depends on the output of the pump and the volume of the vessel! The length of the flushing period between the pumping pulses is at least 10 seconds, preferably approximately 15 seconds to 5 minutes, and more suitably at least 1 minute. It is important that the flushing period is long enough to ensure there is time to remove the solid matter from the pump.

[0020] The lower part of the flushing tank is conical or its surface is otherwise sloping, and the lower part is connected to the outlet of the pump. Most suitably, the nozzle of the conical lower part is connected to the outlet pipe of the drain pump, in which case the aqueous suspension, which is pumped into the flushing tank, flows easily under gravity back into the pump and is able to flush the housing.

[0021] The flushing tank is dimensioned for instance in such a way that its volume ranges from 1 to 3 times the volume of the pump, in which case the solid matter can efficiently be flushed away from inside the pump. On the other hand, it is advantageous that the volume of the tank is not so great that the filling of the tank and the backflushing may stir up the clarified sludge in the process tank Accordingly, the volume of the flushing tank is generally approximately 1-10 times, especially approximately 1-5 times the volume of the pump.

[0022] When the purification unit is operating, purified water which is generated in the process tank is removed regularly through the outlet pipe. In order to enable the flushing function described above, the water stream of the flushing tank, that is the outlet pipe, is located most suitably on the upper edge of the tank, below that level to which the aqueous suspension, which is pumped to flush the pump, rises during the pumping pulses.

[0023] The material from which the conical lower part is made can be the same as the rest of the flushing tank. Preferably, the material is such that solid matter does not adhere to its surface. Suitable materials are different thermoplastics and other structural materials which are covered with thermoplastics. The surface of these can still be separately treated in order to improve the adhesive resistance. Examples of suitable plastics are polyethylene and polypropylene and other polyolefins.

[0024] The accompanying drawings describe a preferred embodiment of the present invention. Figure 1 shows the principle structure of a batch purification unit. The following reference numbers are used in the figure:

1. storage tank

1a. engine compartment

2. process tank
3. junction between the tanks
4. input
5. transfer pump
6. pipe of the transfer pump
7. control centre
8. level controller of the transfer pump
9. aerator trays
10. pipe of the aerator trays
11. compressor
12. process gauge
13. chemical pump control
14. chemical pump
15. chemical hose
16. exit pumping pump
17. exit
18. sludge pump
19. pipe of sludge pump
20. basket for the surplus sludge
21. engine compartment base
22. flushing tank

[0025] The purification unit shown in the drawing is designed for purification of residential waste water. It comprises two main parts, namely the storage tank 1, into which the waste water to be purified is fed through the input pipe 4, and the process tank 2, in which the actual purification is carried out by means of activated sludge. The tanks 1 and 2 are actually separate units, which are connected to each other by a junction 3. The waste water is pumped from the storage tank 1 into the process tank 2 by the transfer pump 5, which is controlled by the level controller 8. The level controller triggers the transfer pump when the level of the waste water fed into the storage tank exceeds a preset limit, in which case the waste water is pumped through the junction 3 by means of the transfer pipe 6 into the process tank 2.

[0026] In the present application, the control centre 7 of the arrangement, which controls the operation of the entire unit, is placed in the engine compartment 1a, which is formed in the storage tank. The reference number 21 stands for the floor of the engine compartment which divides the storage tank unit into two parts. By placing the control centre 7, including the engine compartment 1a inside the storage tank 1, the control centre is effectively separated and isolated from the surrounding space. In addition, a compressor 11 is placed in the engine compartment, which compressor produces compressed air which can be pumped into the waste water to be treated in the process tank, via the aerating pipe 10 and the aerator trays 9, which are placed at the end of that pipe and below the level of the surface of the liquid. Furthermore, a chemical pump 14 is arranged in the engine compartment together with its control unit 13 and chemical hose

15. This pump 14 is used for feeding chemicals into the storage tank 2.

[0027] It is evident that the engine compartment can be placed, besides inside the storage tank, elsewhere, too, and the application described above is only one possible solution.

[0028] Besides the aerator trays/pipe, the process tank of the arrangement comprises the sludge pump 18, with which it is possible to remove sludge that accumulates in the lower part of the tank. In order to collect the sludge, a container for the surplus sludge, i.e. a basket 20 which is connected to the sludge pump through the sludge pipe 19, is arranged in the storage tank.

[0029] The waste water which is pumped into the process tank is aerated by air which is led or bubbled into the water through the aerator trays, in which case the sludge, i.e. activated sludge, which comprises micro-organisms, starts to form in the tank. Due to the effect of these micro-organisms/microbes the nutrients in the waste water break up, which nutrients then form gas and disintegration products, which dissolve in the liquid. The latter settle in the sludge and an activated sludge layer is formed, while the purified water stays on the top of the layer of activated sludge. This water is regularly removed from the tank by the exit pumping pump 16. The operation of this pump is controlled by the process gauge 12. The pump is connected to the flushing tank 22 which is connected to the exit 17 of the process tank.

[0030] A more detailed pump arrangement of the pump structure according to the present invention shown in Figure 1 is described in Figures 2a and 2b. In Figures 2a and 2b, the reference number of the pump is 30, and that of the flushing tank, which is arranged above the pump, is 31; the lower part 32 of the flushing tank is conical and the inlet pipe including flanges 33 is connected to the exit 34 of the pump 30. The reference number of the control unit of the pump is 35 and the reference number of the inlet connected to the process tank is 40. The outlet pipe 36 of the flushing tank is arranged on the upper edge of the cylindrical upper part 37 of the tank, immediately below the end 38, as shown in the figure. In the upper lid of the tank an air bleed valve 39 is arranged, with which it is possible to release the air that is displaced in the tank by the water which is pumped into the tank (see arrows). Correspondingly, it is possible via this air bleed valve to bring replacement air into the tank when the tank is emptied through its conical lower part.

[0031] As seen from above, according to a preferred embodiment, the flushing tank 31 is in direct liquid contact with the pump 30, because no valve is fitted between the inlet 33 of the flushing tank and the outlet 34 of the pump. By means of this solution, the flushing tank is emptied automatically due to the effect of gravity when the pump is stopped. The stream of liquid that exits from the tank flushes hereby the housing of the pump.

Claims

1. A method of flushing the housing of a drain pump (30) which is connected to the process tank of a batch purification unit, according to which method

   - liquid is led through the housing of the pump in order to remove solid matter which has accumulated in the housing,

   characterized in that

   - aqueous suspension is pumped by means of the drain pump (30) into the flushing tank (31), and
   - the aqueous suspension which is pumped into the flushing tank is used for flushing the housing of the drain pump,

   the volume of the aqueous suspension pumped into the tank being at least as great as the volume of the housing of the drain pump.

2. The method according to Claim 1, **characterized in that** the aqueous suspension is pumped from the drain pump (30) to the flushing tank (31), which is placed above the pump, from which tank it is possible to return the aqueous suspension to the housing of the pump under gravity.

3. A method according to Claim 1 or 2, **characterized in that** the flushing tank (31) acts as a buffer which prevents the solid matter exiting from the batch purification unit (1).

4. A method according to any of Claims 1-3, **characterized in that** the aqueous suspension is pumped by the drain pump (30) in pulses into the flushing tank (31).

5. The method according to Claim 4, **characterized in that** the duration of a single pulse is approximately 0.1-20 seconds, preferably approximately 0.1-5 seconds.

6. A method according to any of Claims 1-5, **characterized in that** the duration of the flushing period is at least 10 seconds, preferably approximately 15 seconds to 5 minutes, most suitably approximately 1 minute.

7. A method according to any of the preceding claims, **characterized in that** after the flushing period, liquid is removed from the batch purification unit through the outlet pipe (36) of the flushing tank.

8. A drain pump arrangement in a batch purification unit, which arrangement comprises

- a pump (30) with an outlet (34) and an inlet (40), which is connected to the process tank of the batch purification unit, and through which outlet (34) of the pump it is possible to remove from the batch purification unit aqueous suspension obtained from the process tank,

characterized in that

- a flushing tank (31) is arranged above the pump, which tank has an inlet (33) connected to the outlet (34) of the pump, and an outlet (36) for the discharge of water, the volume of the tank (31) being at least as great as that of the housing of the pump to allow pumping of the entire volume of the pump into the tank in one go.

9. The arrangement according to Claim 8, **characterized in that** the volume of the flushing tank (31) is approximately 1-10, preferably approximately 1-5 times that of the volume of the pump.

10. An arrangement according to Claim 8 or 9, **characterized in that** the lower part of the flushing tank (31) is conical-shaped and connected to the outlet pipe (34) of the pump.

11. An arrangement according to any of Claims 8-10, **characterized in that** the flushing tank (31) is made of a material to which solid matter does not essentially adhere.

12. The arrangement according to Claim 11, **characterized in that** the flushing tank (31) is made of plastic, especially of polyolefin, such as polyethylene or polypropylene, or of a structural material which is covered with plastic.

13. An arrangement according to any of Claims 8-12, **characterized in that** an air bleed valve (39) is arranged on the flushing tank (31).

14. An arrangement according to any of Claims 8-13, **characterized in that** an outlet pipe (36) of the flushing tank is arranged on the upper edge of the flushing tank.

15. An arrangement according to any of Claims 8-14, **characterized in that** the flushing tank is in direct liquid contact with the pump, in which case it is possible to remove the liquid which is fed into the pump automatically by means of gravity when the pump is stopped.

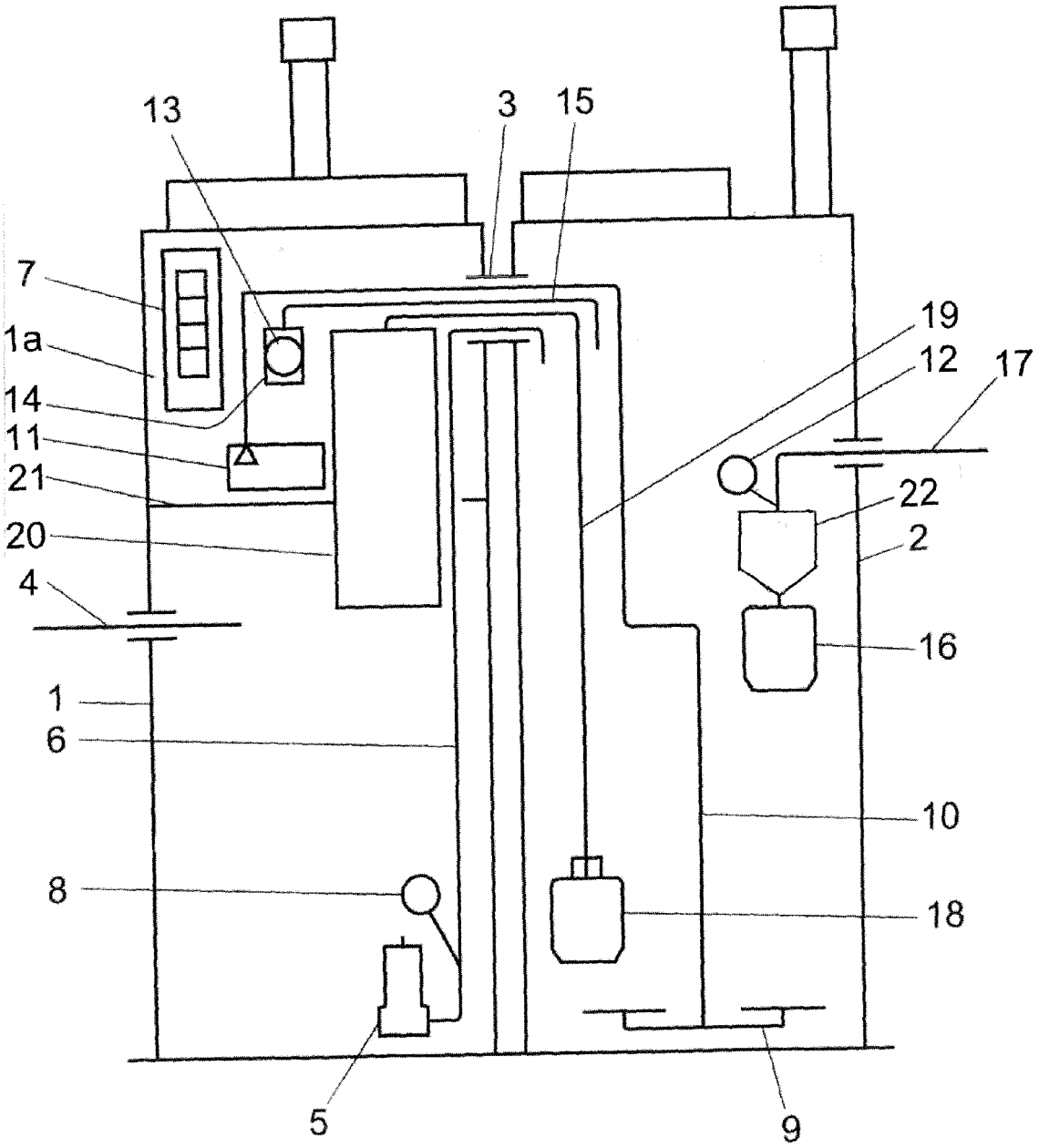

Fig. 1

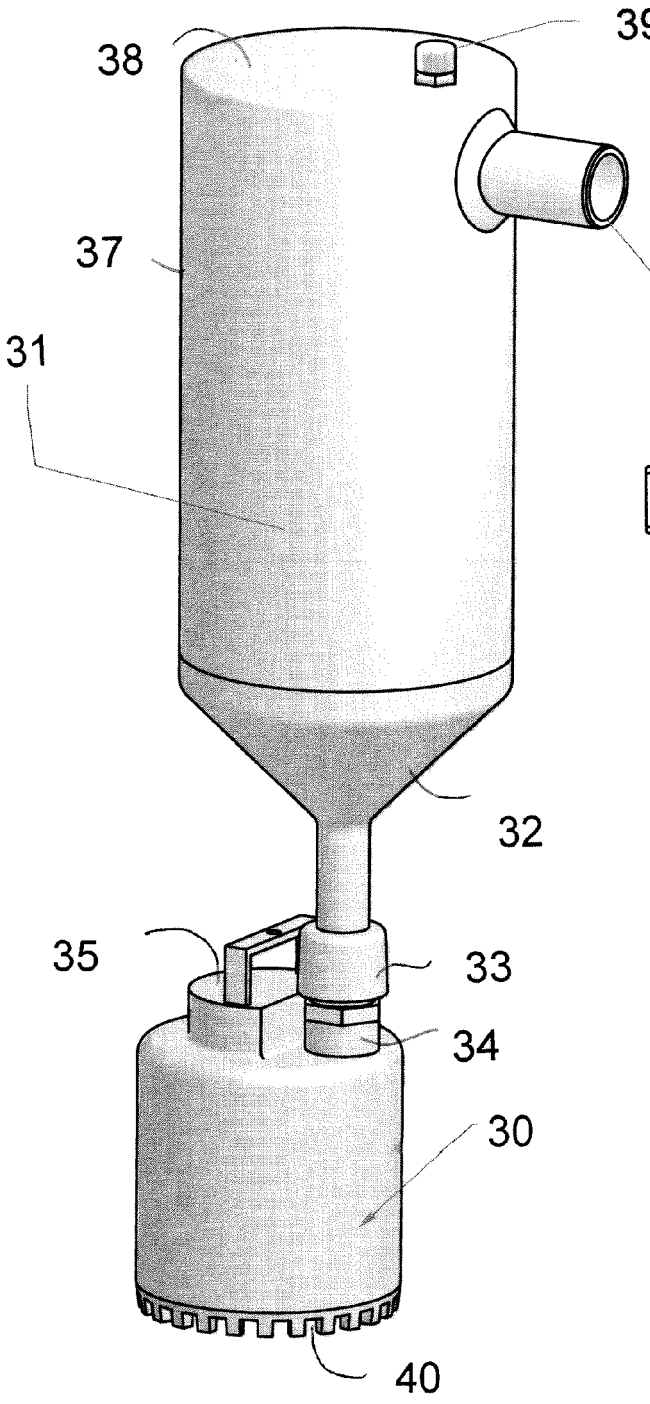

Fig. 2A

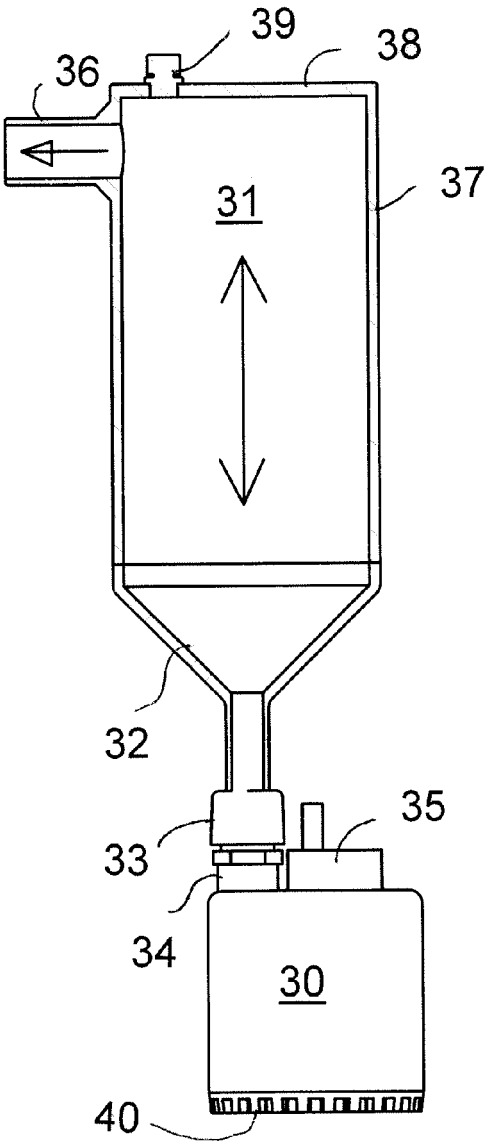

Fig. 2B

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 09 15 0504

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 497 181 C (AUTO PRIME PUMP COMPANY) 9 May 1930 (1930-05-09) * the whole document * -----	8-15	INV. E03F5/22
A	FR 2 837 244 A (IMPLANTATION ET DE DIFFUSION D [FR]) 19 September 2003 (2003-09-19) * figure 1a * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

E03F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 May 2009	Flygare, Esa

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 15 0504

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-05-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 497181 C	09-05-1930	NONE	
FR 2837244 A	19-09-2003	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1566498 A **[0005]**
- DE 20105661 **[0005]**
- EP 1566598 A **[0005]**
- JP 2004351400 B **[0006]**
- JP 20001271782 B **[0006]**