

(19)



(11)

EP 1 997 971 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

03.12.2008 Bulletin 2008/49

(51) Int Cl.:

E03F 5/22 (2006.01)

(21) Application number: **08157037.6**

(22) Date of filing: **28.05.2008**

(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 MT NL NO PL PT
RO SE SI SK TR**

Designated Extension States:

AL BA MK RS

(30) Priority: **28.05.2007 FI 20075383**

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(54) **Wastewater pumping station**

(57) A wastewater pumping station, which includes a space for collecting wastewater and one or more pumps (4) for pumping wastewater onward towards further treatment. The invention has been implemented such that the

space consists of two basins (1, 2) connected to each other, one of which is a pump basin (1) and the other a combined suction and reserve capacity basin (2).

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Description

[0001] This invention relates to a wastewater pumping station which includes a space for collecting wastewater and one or more pumps for pumping wastewater onward towards further treatment.

[0002] The pumping of sewage case-specifically requires reserve capacity for water in connection with the pumping station. This is to prepare e.g. for that more water is incoming momentarily than the pumps are able to pump. Such situations occur e.g. as the result of power failures or pump malfunctions, particularly if there is no possibility to arrange an overflow in a suitable place.

[0003] Many arrangements are previously known. The pumping station can be made concrete-structured with a sufficiently large suction basin size. Then, a disadvantage is high building costs. Furthermore, if the area of the bottom of the suction basin is large, there occurs floating and bottom sludging, as a result of which there can be cloggings in pumps and/or pipelines. If a large volume of wastewater stays in the suction basin for a long time, odour nuisances (hydrogen sulphide) start to occur which are further increased by the large area of water.

[0004] Another known arrangement is to make the pumping station manufactured either of concrete or plastic extremely deep, whereby normally the starting and stopping levels are low and the reserve capacity is above them. Then, a disadvantage is the unnecessary lowering of the water level, whereby the lifting height required of the pumps is increased and the energy costs grow.

[0005] Advantageous plastic-structured pumping stations are not manufactured with larger diameters than 3 m due to practical reasons (e.g. transport problems and prices of manufacturing moulds). If in these pumping stations the pumps are additionally wanted low in a separate dry space, the effective water volume is equivalently decreased, whereby the pumping station has to be made very high and installed deep into the ground. Then also the useless volume below the pump space grows, which increases the manufacturing costs. Furthermore, great buoyancy is created for deep pumping stations manufactured of plastic, which requires as counterweight a large concrete slab.

[0006] It is further known to locate two pieces of cylinders adjacently such that one forms a pump space and the other a suction space. Also these both become high and deep when aiming at great reserve capacity. Also then, the inlet pipe has to be located very low, which causes an increase of the geodetic lifting height. Furthermore, there has to be a large concrete slab below these due to buoyancy, in which slab both cylinders are fastened in order to create no bending stresses in the connection pipes between them or they must be otherwise fastened tightly in each other. If they have been connected to each other in the manufacturing stage, their transport is awkward, because the total height of basins being 3 m of their diameter in the vertical position is over 6 m and, on the other hand, connecting them together at the

site can be risky.

[0007] The object of this invention is to eliminate these disadvantages of known prior art. The wastewater pumping station according to the invention is characterised by that the space consists of two basins connected to each other, one of which is a pump basin and the other a combined suction and reserve capacity basin.

[0008] An advantageous embodiment of the wastewater pumping station according to the invention is characterised by that both basins are substantially cylindrical, and that the pump cylinder is substantially in the vertical position and the combined suction and reserve capacity cylinder is almost in the horizontal position.

[0009] Another advantageous embodiment of the wastewater pumping station according to the invention is characterised by that the cylinder in the almost horizontal position has been tilted in relation to the horizontal direction such that it slopes towards the cylinder in the vertical position, whereby a tilt angle is over 0°, advantageously over 1°.

[0010] A further advantageous embodiment of the invention is characterised by that the tilt angle is smaller than 8°.

[0011] As an advantage of the invention, it can be mentioned that the disadvantages occurring in the known prior art have been eliminated and a possibility is provided to make a reserve capacity of almost whatever size in practice very cost-effectively.

[0012] Next, the invention is described in more detail by means of an advantageous embodiment example by referring to the accompanying drawings in which

[0013] Fig. 1 shows a cross section of a wastewater pumping station according to the invention.

[0014] Fig. 2 shows a section along line A-A of Fig. 1.

[0015] Fig. 3 shows a tilt of a suction pipe of a pump as cut.

[0016] Fig. 4 shows a bevel of the end of the suction pipe of the pump as cut.

[0017] The pumping station shown in the drawings consists of two cylinders which can be e.g. of plastic or steel. A cylinder 1 forms a pump space and a cylinder 2 forms a combined suction basin and reserve capacity basin. The cylinder 1 is in the vertical position, whereas the cylinder 2 is almost in the horizontal position such that it forms in relation to the horizontal plane an angle α and falls towards the cylinder 1. The angle α is advantageously between over 0°, advantageously over 1° but below 8°.

[0018] At the end of the substantially horizontally-positioned cylinder 2 which is towards the cylinder 1, a suction chamber 3 has been made. In the cylinder 1, typically two pieces of sewage pumps 4 have been installed in a conventional way. The number of the pumps is chosen according to requirement and it does not limit the invention in any way.

[0019] In both cylinders, there are hatches 5, 6 for maintenance. In the cylinder 2, there is also a ventilating pipe 7. A central electric box 8 can be located e.g. above

the cylinder 1, inside of it or farther from the pumping station. If required, e.g. at the end of the cylinder 2 is located an overflow pipe 9.

[0020] From the cylinder 1 starts a pressure pipe 10. Sewage water arrives in the cylinder 2 typically from a pipe 11 located at its end part and flows along the lower part of the cylinder 2 to the suction chamber 3. In principle, the pipe 11 can also arrive in the lower part of the cylinder 2 from the side.

[0021] In order to avoid the remaining of solids on the surface of the cylinder 2 at the point of a starting level 12, a flow velocity v has to be just before the suction space about 0.2-0.3 m/s, advantageously 0.25 m/s. Then, a height h_1 of the starting level 12 from the lower surface of the cylinder 2 has to be selected in accordance with this velocity and it is dependent on the volume flow of the pump and the diameter of the basin 1.

[0022] In order to obtain sufficient effective volume without a too high starting frequency of the pump, the required reserve capacity is arranged in the suction chamber and, in accordance with this, the suction chamber is dimensioned such that too high a drop h_2 is not created on a stopping level 13. Otherwise, too much air will be mixed with the water which can cause problems in the operation of the pump. For example, the size of the suction chamber is dimensioned such that h_2 is about 50-150 mm.

[0023] In order to avoid the accumulation of air in the stopped pump, the suction pipe can be set according to Fig. 3 at an angle β of about 0.5° . Another alternative is shown in Fig. 4 in which the end of the suction pipe is bevelled upwards for an angle ξ which can be e.g. about $1-3^\circ$. This way, practically the total volume of the cylinder 2 is obtained as reserve capacity and the pumping station can be made industrially an advantageous pumping station manufactured of plastic without limitations on the reserve capacity and large additional costs incurred by it.

[0024] Furthermore, it is easy to place on top of the cylinder 2 a Styrox block or suitable heat-insulating gravel as the heat insulation. Because the pumping station is low, the groundwater does not cause great buoyancy or buoyancy at all, whereby it can be anchored with concrete slabs 16 in which are fastened e.g. bands 17, which is a known arrangement in other horizontal-positioned basins.

[0025] It is well known by those skilled in the art that the invention does not limit to the embodiment examples described above, but it may vary within the scope of the enclosed patent claims. Cylindrical basins were discussed above, but also basins of other shapes can be considered.

Claims

1. A wastewater pumping station, which includes a space for collecting wastewater and one or more pumps (4) for pumping the wastewater onward to-

wards further processing, **characterised in that** the space consists of two basins (1, 2) connected to each other, one of which is a pump basin (1) and the other is a combined suction and reserve capacity basin (2).

2. A wastewater pumping station according to claim 1, **characterised in that** both basins (1, 2) are substantially cylindrical, and that the pump cylinder (1) is substantially in the vertical position and the combined suction and reserve capacity cylinder (2) is almost in the horizontal position.
3. A wastewater pumping station according to claim 2, **characterised in that** the cylinder (2) almost in the horizontal position is tilted (a) in relation to the horizontal direction such that it slopes towards the cylinder (1) in the vertical position, whereby a tilt angle (a) is over 0° , advantageously over 1° .
4. A wastewater pumping station according to claim 3, **characterised in that** the tilt angle (a) is smaller than 80° .
5. A wastewater pumping station according to any one of claims 1-4, **characterised in that**, at the end of the substantially horizontally-positioned cylinder (2) which is towards the cylinder (1), a suction chamber (3) has been made.
6. A wastewater pumping station according to any one of claims 1-5, **characterised in that** an inlet pipe (11) of wastewater is located in the lower part of the upper end of the horizontally-positioned cylinder (2) or close to the end on the side of the cylinder in the lower part of the cylinder.
7. A wastewater pumping station according to claim 5, **characterised in that** the end of a suction pipe (14) in the suction chamber (3) has been tilted for about $0.2-2^\circ$, advantageously about 0.5° .
8. A wastewater pumping station according to claim 5 or 7, **characterised in that** the end of the suction pipe (14) in the suction chamber (3) has been bevelled for about $1-3^\circ$.

Fig. 1

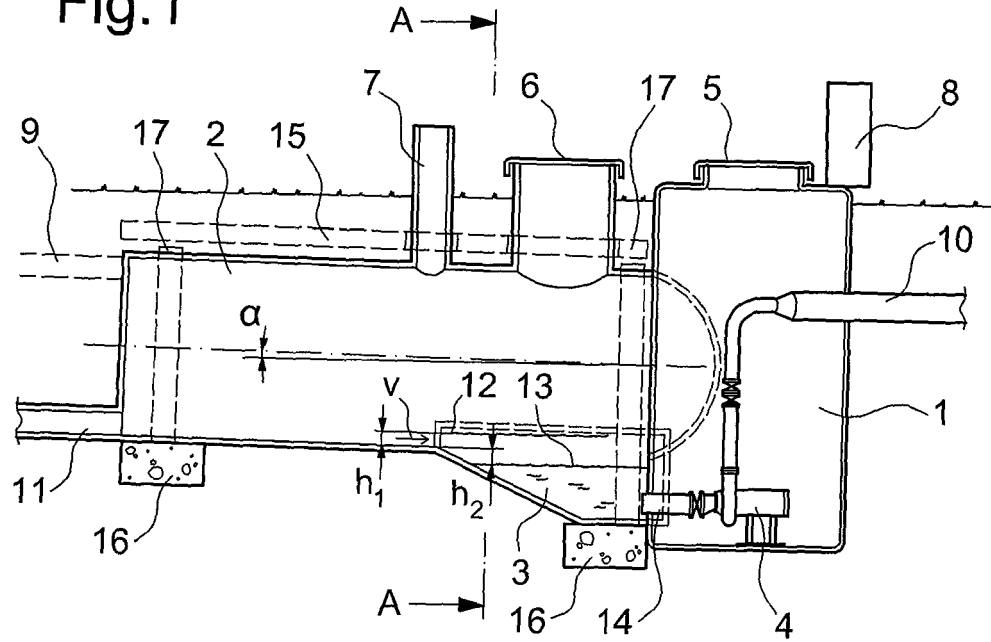


Fig.3

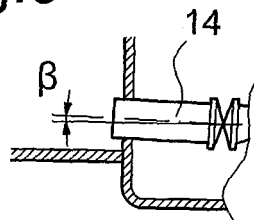


Fig.2

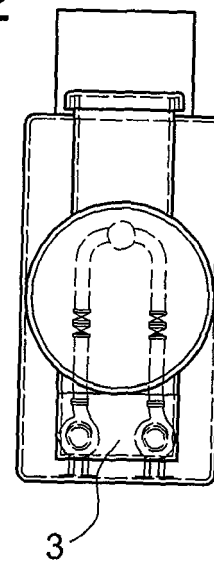
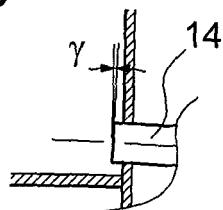


Fig.4



A - A