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(54) **Pump arrangement for pumping liquid by means of compressed air.**

(57) The pump arrangement has a pump chamber (1) with an inlet opening (2) and a discharge opening (3) to which is connected a discharge pipe (4). The inlet opening (2) is placed at a higher level than the discharge opening (3). To the inlet opening (2) is connected an inlet pipe (9) which is taken down to a level in the liquid where the pressure head (H) is higher than the pressure head (h) of the pump arrangement. When the pump chamber (1) is filled with liquid, air is supplied through a pipe (6) from a blower (7), whereby the liquid is forced out through

the discharge pipe (4). Then the pump arrangement is aired when a valve (8) opens, thus supplying new liquid to the pump arrangement.

The pump arrangement has no valves and has therefore free throughput in the whole of its length. It can therefore pump liquid containing larger impurities such as plastics bags, rope ends, etc. without choking.

The pump can also be used for cleaning waste water of sludge. The effect consumption is lower than in known pumps.

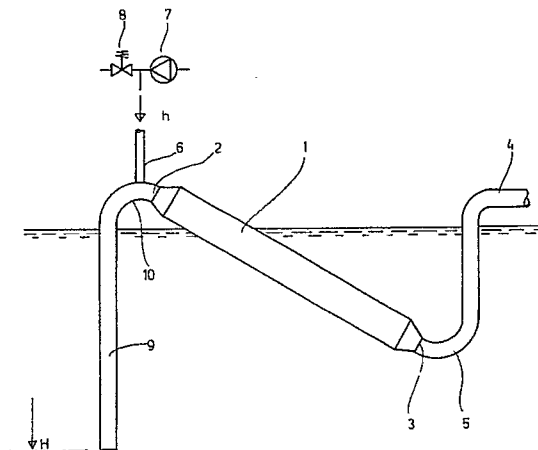


FIG 1

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PUMP ARRANGEMENT FOR PUMPING LIQUID BY MEANS OF COMPRESSED AIR.

The present invention relates to a pump arrangement of the kind described in the introduction to claim 1.

Such pump arrangements are known e.g. from the description of Norwegian patent No. 4.100, French patents Nos. 806.643 and 1.033.695 and U.S.A. patent No. 1.072.562.

These known pumps all have a valve on the inlet side which closes when compressed air is blown into the pump chamber.

It is the purpose of the present invention to describe a pump in which the said valve in the inlet can be omitted, thus making the pump more simple in its construction and more robust and dependable than known pumps. This is achieved by shaping the pump as shown in the characterizing part of claim 1.

As the pump arrangement according to the invention is open during the whole throughput action it can also pump liquids containing large objects such as plastics bags, rope ends and the like. Furthermore, it can be used to pump water containing live fish.

Claim 2 deals with an embodiment of the pump chamber of a pump arrangement according to the invention.

Claim 3 deals with another embodiment of the pump chamber of a pump arrangement according to the invention.

Claim 4 deals with a pump arrangement according to the invention in which the pump acts as a liquid pump.

Claim 5 deals with a pump arrangement in which the pump preferably pumps sludge from a sludgy liquid.

The invention will be explained in detail below with reference to the drawing in which

fig 1 is a schematic embodiment of a pump arrangement according to the invention, and

fig. 2 is a schematic drawing of another embodiment of a pump arrangement according to the invention.

As shown in the drawing a pump arrangement according to the invention has a pump chamber 1, with an inlet opening 2 and a discharge opening 3. To the discharge opening is connected a discharge pipe 4, preferably by a U-shaped bend 5. A supply pipe 6 for compressed air is connected to the top part of the pump chamber 1. By way of example the compressed air can be supplied from a blower 7 so that compressed air is pumped into the pump arrangement when a magnet valve 8 is closed. The pump arrangement is aired, when the valve 8 is open. The valve 8 can be activated in various ways, e.g. by a not shown level sensor in the

discharge pipe 4. The pump arrangement can also be spring suspended and designed so that it can activate a not shown limit switch in a bottom position, when it is filled with liquid, and in a top position, when it is emptied of liquid.

Connected to the inlet opening 2 to the pump chamber 1 is an inlet pipe 9, reaching from the inlet opening 2 down into the liquid to a level where the pressure head H is higher than the pressure head of the pump arrangement and which is preferably lower than the lowest part of the pump chamber.

The inlet pipe 9 can also - as shown at the bottom of fig. 2 - enter a pump well 11 from which the pump arrangement pumps liquid. The pump arrangement can in this case be buried in the ground.

When the valve 8 is open liquid will be forced through the inlet pipe 9 into the pump chamber 1.

When the pump chamber 1 is filled with liquid and a corresponding liquid level in the discharge pipe 4 is reached, the valve 8 will close and the blower 7 will force compressed air into the pump chamber.

As the pressure head H at the bottom of the inlet pipe is higher than the pressure head h of the pump arrangement the supplied compressed air will force the liquid out of the pump chamber 1 and out through the discharge pipe 4.

When the pump arrangement is emptied of liquid a sensor - which by way of example could be placed in the discharge pipe - will register this, and the valve 8 will close. Then another volume of liquid will be forced into the pump chamber.

The consumption of air is only a few per cent higher than the volume of liquid being pumped. If a volume of liquid of 1 m³ is to be raised 1 m, a blower effect of 8W is needed. This effect is essentially lower than for known pumps.

The blower 7 can either be in continuous operation, or it can be connected to the control system for the valve 8, so that it stops when the valve 8 is open.

As a fixed quantity of liquid is discharged, depending on the dimensions of the pump arrangement, for each pump stroke, the pump arrangement can also be used as a flow meter. Such a pump can send a signal to another pump, which can be a dosing pump for chemicals.

As shown in fig. 1 the pump chamber 1 can be embodied as an oblong, preferably cylindrical, pipe oriented with a backward slope from the inlet opening 2 towards the discharge opening 3. This gives the pump with the inlet pipe 9, the pump chamber, and the discharge pipe 4 the shape of an N.

The pump chamber 1 may also - as shown in fig. 2 - have the shape of an oblong, preferably cylindrical, pipe with a horizontal position.

With the embodiment shown in the figure the lower edge 10 of the inlet opening 2 is placed at a higher level than the upper edge 12 of the pump chamber 1. The pump arrangement then functions as a liquid pump.

If the lower edge 10 of the inlet opening 2 is moved down to a level which is lower than the upper edge of the pump chamber 1, but higher than the pump chamber's lower edge 13, part of the liquid supplied to the pump chamber will be taken back to the inlet pipe 9 during the pump stroke. If the fluid being pumped is sludgy the sludge which collects on the bottom of the pump chamber 1 will thus be pumped away through the discharge pipe 4, whereas pure liquid will be taken back to the inlet pipe 9.

In the described embodiment the pump arrangement can thus be used for cleaning of waste water for sludge.

Within the framework of the invention there may be other embodiments of the invention. For example the pump chamber shown in fig. 1 can be embodied with a beginning part with an inclined downward slope and then with a horizontal part and then with a part inclined downwards.

Claims

1. Pump arrangement for pumping liquid by means of compressed air with a pump chamber (1) which is completely or partially immersed in the liquid, a discharge pipe (4) reaching from the bottom of the pump chamber and an inlet opening (2), which connects the pump chamber (1) with the liquid, and a supply pipe (6) for compressed air, which is connected to the upper part of the pump chamber, and through which the pump chamber is alternately connected to a compressed-air source (7) and air-ed to the surrounding atmosphere, **characterized** by the discharge pipe (4) being connected to a discharge opening (3) at the bottom of the pump chamber (1), preferably by a U-shaped bend (5) and by the inlet opening (2) being connected to an inlet pipe (9) reaching from the inlet opening (2) down into the liquid to a level where the pressure head (H) is higher than the pressure head (h) of the pump arrangement, and which is preferably lower than the lowest part of the pump chamber, and by the bottom (10) of the inlet opening (2) being placed at a higher level than the discharge opening (3).

2. Pump arrangement according to claim 1 **characterised** by the pump chamber (1) being embodied as an oblong, preferably cylindrical, pipe

with an inclined orientation downwards from the inlet opening (2) towards the discharge opening (3).

3. Pump arrangement according to claim 1, **characterised** by the pump chamber (1) being embodied as an oblong, preferably cylindrical, pipe which is mainly of a horizontal orientation.

4. Pump arrangement according to claims 1 and 3, **characterised** by the lower edge (10) of the inlet opening (2) being placed at a higher level than the upper edge (12) of the horizontally oriented pump chamber (1).

5. Pump arrangement according to claims 1 and 3, **characterized** by the lower edge (10) of the inlet opening (2) being placed at a lower level than the upper edge (12), but at a higher level than the lower edge (13) of the pump chamber (1).

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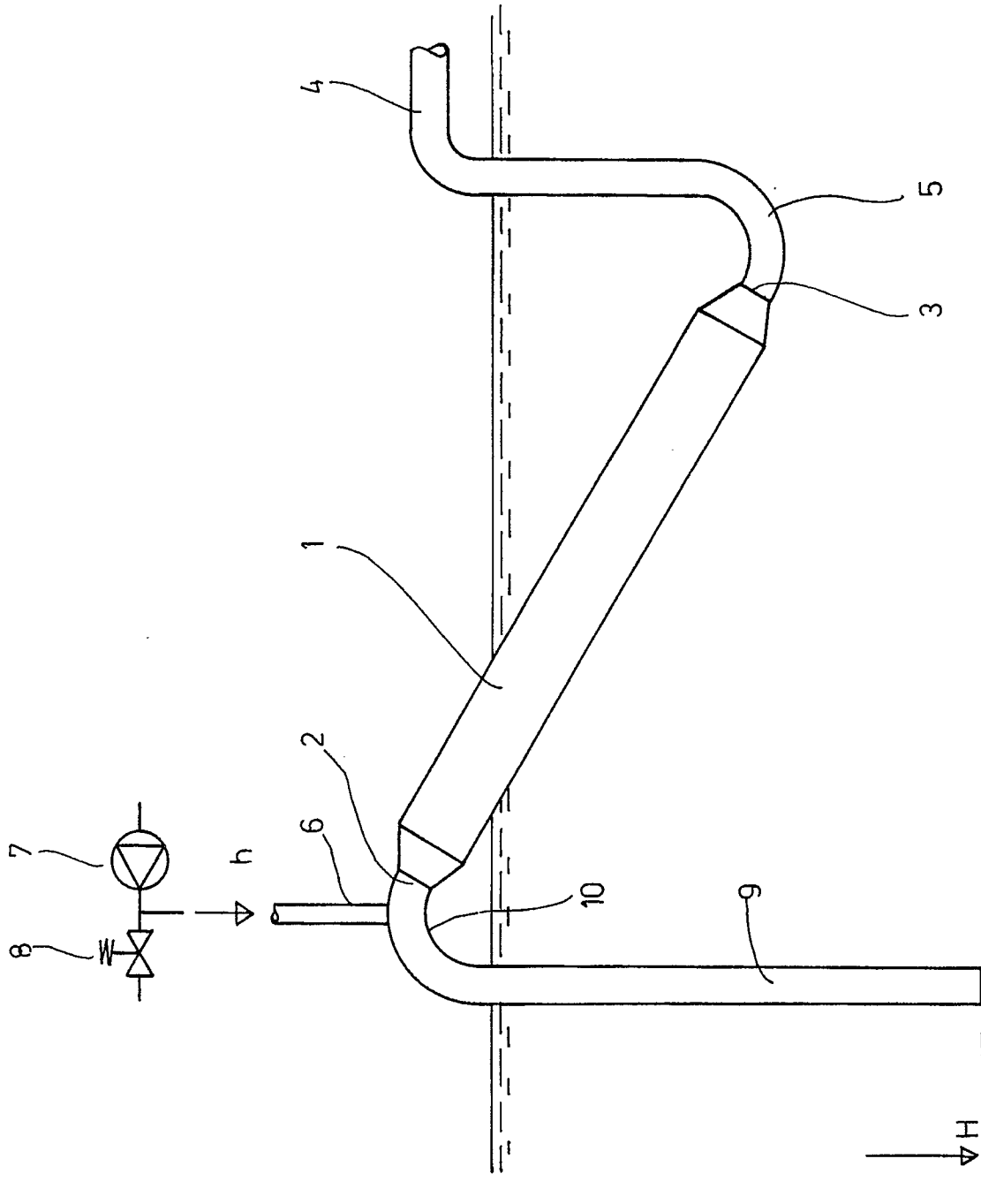


FIG 1

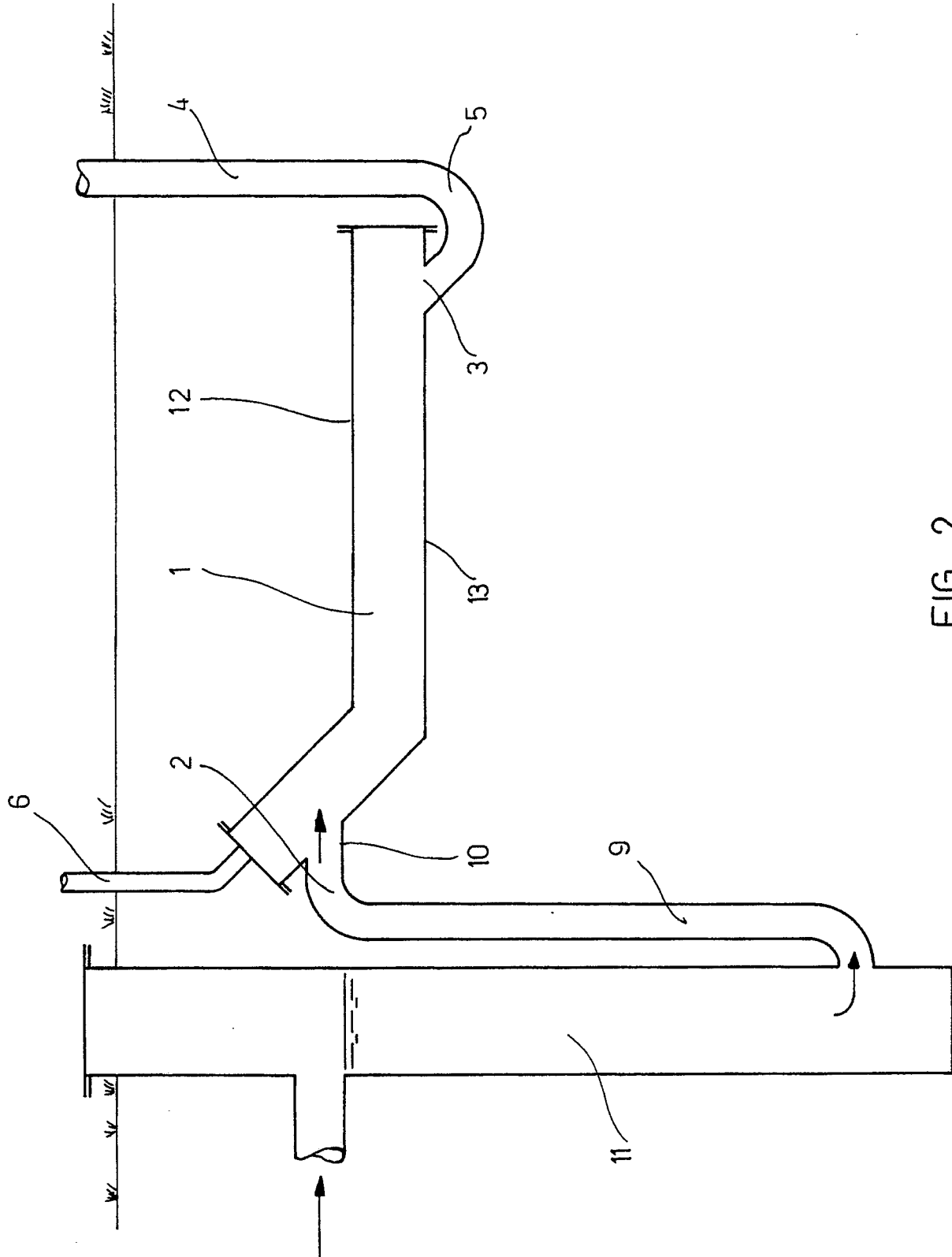


FIG 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 90 61 0047

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-2227448 (ECODYNE) * page 3, line 8 - page 5, line 24; figure 1 * ---	1, 3, 5	F04F1/06
A	GB-A-245238 (AMICE) * page 3, lines 17 - 81; figure 1 * ---	1, 4	
A	DE-C-960250 (VEDDER) * page 3, line 24 - page 4, line 6; figure 1 * ---	1	
A,D	FR-A-806643 (FLOTTMANNKONZERN) * page 3, lines 29 - 93; figure 1 * ---	1	
A	GB-A-241960 (BATES) * page 2, line 123 - page 3, line 64; figures 1-3 * -----	1, 2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F04F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01 OCTOBER 1990	Examiner BERTRAND G. <i>SG</i>
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	