

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

**EP 0 623 713 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:

**21.07.1999 Bulletin 1999/29**

(51) Int Cl.<sup>6</sup>: **E03F 5/22**

(21) Application number: **94850059.0**

(22) Date of filing: **20.04.1994**

(54) **A method and a device for automatic circulation in a waste water pump station**

Verfahren und Einrichtung für automatische Zirkulation in einer Abwasserpumpanlage

Procédé et dispositif pour la circulation automatique dans une station de pompage d'eau usée

(84) Designated Contracting States:  
**DE DK FR GB IT NL**

(30) Priority: **29.04.1993 SE 9301459**

(43) Date of publication of application:  
**09.11.1994 Bulletin 1994/45**

(73) Proprietor: **ITT FLYGT AB**  
**S-171 25 Solna (SE)**

(72) Inventor: **Södergard, Bengt**  
**S-194 41 Upplands Väsby (SE)**

(74) Representative: **Larsson, Sten**  
**ITT FLYGT AB**  
**Box 1309**  
**171 25 Solna (SE)**

(56) References cited:  
**EP-A- 0 472 509** **SE-B- 463 218**

**EP 0 623 713 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

## Description

**[0001]** The invention concerns a device for providing circulation in pump stations which are parts of a municipal sewage system.

**[0002]** As is described in the Swedish Patent Application 7908743-3 sludge banks occur in pump stations and other tanks in a sewage system as the circulation is not good enough. Sludge banks mean a lot of problems such as a bad smell, risk for explosions, corrosion problems etc.

**[0003]** According to the Patent Application mentioned, the problems have been solved by arranging a valve in the pump outlet, which is opened temporarily thus obtaining a circulation and flushing in the pump station. The sludge banks are dissolved and the fluid is homogenized.

**[0004]** The adjustment of the valve has up to now been controlled by electric means by help of a linear motor which acts upon a slide in the valve. A disadvantage with this solution, in addition to a relatively high cost, is that it easily becomes clogged as the pumped medium normally contains large amounts of solid bodies such as stones, rags and other objects. If a stone is stuck in the valve slide, the electric motor may break down.

**[0005]** Another disadvantage is that the motor of the valve is electrically driven which means specific installation problems where explosive gas may occur.

**[0006]** Another way to solve the problem to control the valve by help of the pump pressure is shown in Swedish Pat No 8900597-9 and EP - A - 0 472 509. Here the under pressure created by the flow through the valve is utilized to move a valve element into a closed position after a certain time. This solution has however the disadvantage that the under pressure is not always sufficiently strong to be able to move the element into closed position.

**[0007]** The purpose of this invention is to obtain a device which in a simple and reliable way controls the valve, independent of the pressure situation in the surrounding area. This is obtained by help of the method and the device stated in the claims.

**[0008]** The invention is described more closely below with reference to the enclosed drawings.

**[0009]** Fig 1 shows a pump station with a pump unit and attached valve. Figs 2 to 4 show the principle design of the valve in different operating positions.

**[0010]** In the drawings 1 stands for a pump station with a submersible pump unit 2 connected to a pressure pipe 3. 4 stands for the pump housing having an inlet 5, while 6 stands for a mixing valve mounted on the pump housing 4. 7 stands for a valve housing and 8 its outlet with a bend 9. 10 stands for a valve ball and 11 its seat. 12 and 13 stand for diaphragms, 14 and 15 cups, 16 a conduit, 17 a control device and 18 a shoulder in the outlet.

**[0011]** The device operates in the following manner: Normally the valve 6 is closed and the pumped medium

is transported from the pump housing 4 and into the pressure pipe 3. The flow direction is shown by the Arrow A.

**[0012]** During certain times, for instance at pump start, the valve is open, which means that a certain amount of the pumped medium flows through the valve, arrow B, and obtains a strong agitation in the pump station wrecking possible sludge banks. After a certain time, the valve is closed and the pumping takes place in the normal way.

**[0013]** According to a preferred embodiment the valve 6 comprises a valve housing 7 with an outlet 8 ended by a bend 9. Within the valve housing 7 a valve cup 14 is provided which holds a diaphragm 12 with a valve ball 10. This is arranged to be able to close the passage through the valve housing 7 when it rests on a seat 11.

**[0014]** In Fig 2 the valve is shown in open position which means that circulation takes place within the pump station. The valve ball 10 then takes a position entirely beside the flow, not hindering it. The flow through the valve now creates pressure differences which may be used for controlling the valve function. Depending on among other things that the cross section in the outlet 8 is smaller than the cross section in the valve housing 7, the pressure in the former will be higher. The difference may also be increased by a shoulder 18 or a bend 9 in the outlet which further increases the pressure.

**[0015]** The mentioned pressure difference is utilized by arranging rooms in the valve housing 7 and the outlet 8 which are delimited by diaphragms 12 and 13 respectively, said rooms being connected by a conduit 16.

**[0016]** The pressure difference between the inner of the valve housing 7 and the outlet 8 when there is a flow through the valve, causes the diaphragm 13 to be pressed inwards which means that the medium, oil, within the rooms is pressed through the conduit 16 towards the room delimited by the diaphragm 12. The latter will then be pressed outwards, upwards in the drawing, and act upon the ball 10 in a closing direction, (Fig 3). When the ball has been moved a distance upwards, it will be influenced by the flow which brings it to a sealing alignment with the seat 11.

**[0017]** The time it takes for the oil to move from the room delimited by the diaphragm 13 to the room delimited by the diaphragm 12 is controlled in a suitable way by help of a restriction in the conduit 16.

**[0018]** In Fig 4 the valve is shown in a closed position which is the case after a predetermined time. Pump pressure will now prevail within the valve housing 7 as long as the pump operates. This means that the diaphragm 12 is pressed downwards to its original position and the oil is pressed back towards the diaphragm 13 which is not influenced by the pump pressure and thus resumes its original, bending design. When the pumping stops the pressure decreases and the valve ball 10 is moved by gravity to its original position. The valve is then open waiting for next pump start.

[0019] In the description above a loose valve ball is used which seals against a seat in order to close the valve. Also other movable possibly turnable elements may be used as closing means and are within the scope of the invention.

[0020] In the description and especially in the drawings it is stated that the valve ball is actuated upon by a diaphragm 12 which has a corresponding number 13 in the outlet 8. The rooms being delimited by the diaphragms communicating via a conduit 16. It should be stressed that the drawings just show a preferred embodiment. The design of the diaphragms as well as that of the rooms may vary within the scope of the invention, to utilize the pressure difference between two different parts in the valve.

## Claims

1. A method to control a valve for obtaining circulation in sewage water pump stations containing one or several pump units, preferably centrifugal pumps of the submersible type, one or several provided with mixing valves, which automatically, during a certain limited time period (periods) connect the pressure side of a pump with the pump station thus obtaining a circulation of the pumped medium and where the alternate return connection to the pump station is carried out by help of a valve comprising a valve housing connected to the pressure side of the pump and an outlet nozzle, the control of the valve being obtained by help of a movable valve element (10) which, in dependence of the pressure situation in the valve, in its one rest position seals against a seat (11) in the valve housing (7) thus closing the latter and which in its other rest position is contained within a diaphragm (12) arranged outside the flow through the valve, characterized in that the valve element (10) is acted upon to move from its first to its second rest position by gravity and from its second to its first rest position by the pressure difference between the outlet part (8), higher pressure, and the inner of the valve housing (7), lower pressure, caused by the flow through the valve, the pressure in outlet part (8) acting upon two separate diaphragms (12) and (13).
2. A device for carrying out the method according to claim 1, characterized in that it comprises a valve housing (7) with an outlet part (8), the inner of the housing (7) as well as the inner of the outlet part (8) being provided with one diaphragm each (12) and (13) respectively, which delimit rooms (14) and (15) respectively communicating via a conduit (16) and that the diaphragm (12) is arranged to be able to move the valve element (10) in a closing direction towards a seat (11) in the valve housing (7) thus interrupting the flow there through.

3. A device according to claim 2, characterized in that a controlling device (17) is arranged to control the flow through the conduit (16) which in its turn determines the closing time for the valve.
4. A device according to claim 2, characterized in that the outlet part (8) is provided with an interior shoulder (18) which adds to the pressure increase within the outlet part (8),
5. A device according to claim 2, characterized in that the outlet part (8) is terminated by a bend (9) which directs the flow from the valve and also adds to the pressure increase within the outlet part (9).

## Patentansprüche

1. Verfahren zum Steuern eines Ventils zum Erzielen von Zirkulation in Abwasser-Pumpstationen, die eine oder mehrere Pumpeneinheiten, vorzugsweise Zentrifugalpumpen des tauchbaren Typs, enthalten, von denen eine oder mehrere mit Mischventilen versehen sind, die automatisch während einer bestimmten, begrenzten Zeitdauer (Zeitdauern) die Druckseite einer Pumpe mit der Pumpstation verbinden und dadurch eine Zirkulation des umgepumpten Mediums erzielen, und wobei die sich daran anschließende Zurückverbindung zu der Pumpstation mit Hilfe eines Ventils ausgeführt wird, das ein mit der Druckseite der Pumpe verbundenes Ventilgehäuse und eine Austrittsdüse aufweist, wobei die Steuerung des Ventils erzielt wird mit Hilfe eines beweglichen Ventilelements (10), das in Abhängigkeit von der Drucksituation in dem Ventil in seiner einen Ruheposition dicht an einem Sitz (11) in dem Ventilgehäuse (7) anliegt und letztes somit schließt und in seiner anderen Ruheposition in einer Membran (12) enthalten ist, die außerhalb der Strömung durch das Ventil angeordnet ist, dadurch gekennzeichnet, daß das Ventilelement (10) durch Schwerkraft zur Ausführung einer Bewegung aus seiner ersten Ruheposition in seine zweite Ruheposition veranlaßt wird und durch die durch die Strömung durch das Ventil verursachte Druckdifferenz zwischen dem Austrittsteil (8) mit höherem Druck und dem Inneren des Ventilgehäuses (7) mit niedrigerem Druck zur Ausführung einer Bewegung aus seiner zweiten Ruheposition in seine erste Ruheposition veranlaßt wird, wobei der Druck in dem Austrittsteil (8) auf zwei separate Membranen (12) bzw. (13) wirkt.
2. Vorrichtung zum Durchführen des Verfahrens nach Anspruch 1, dadurch gekennzeichnet, daß sie ein Ventilgehäuse (7) mit einem Austrittsteil (8) aufweist, wobei das Innere des Gehäuses (7) sowie das Innere des Aus-

trittsteils (8) mit je einer Membran (12) bzw. (13) versehen sind, die Räume (14) bzw. (15) abgrenzen, die über einen Kanal (16) kommunizieren, und daß die Membran (12) dazu in der Lage ist, das Ventilelement (10) in Schließrichtung in Richtung auf einen Sitz (11) in dem Ventilgehäuse (7) zu bewegen und dadurch die Strömung durch dieses hindurch zu unterbrechen.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß eine Steuervorrichtung (17) dazu ausgebildet ist, die Strömung durch den Kanal (16) zu steuern, wodurch wiederum die Schließzeit für das Ventil bestimmt wird.
4. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß das Austrittsteil (8) mit einer inneren Schulter (18) versehen ist, die den Druckanstieg in dem Austrittsteil (8) fördert.
5. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß sich an das Austrittsteil (8) eine Biegung (9) anschließt, die die Strömung von dem Ventil wegführt und ebenfalls den Druckanstieg in dem Austrittsteil (9) fördert.

#### Revendications

1. Procédé pour commander une vanne pour obtenir une circulation dans des stations de pompage d'eaux usées comprenant une ou plusieurs unités de pompe, de préférence des pompes centrifuges du type submersible, une ou plusieurs de celle-ci étant munie(s) de vannes de mélange, qui automatiquement, pendant une certaine période de temps limitée (périodes), relie le côté de pression d'une pompe avec la station de pompage en obtenant ainsi une circulation du milieu pompé et où la connexion alternée de retour à la station de pompage est assurée à l'aide d'une vanne comprenant un boîtier de vanne relié au côté de pression de la pompe et une buse de sortie, la commande de la vanne étant obtenue à l'aide d'un organe de vanne mobile (10) qui, de manière dépendante de la situation de pression dans la vanne dans sa position de repos s'applique de manière étanche contre un siège (11) dans le boîtier de vanne (7) en fermant ainsi ce dernier et qui, dans son autre position de repos, est contenu dans une membrane (12) agencée à l'extérieur de l'écoulement au travers de la vanne, caractérisé en ce que l'organe de vanne (10) est actionné pour se déplacer depuis sa première vers sa deuxième position de repos sous l'effet de la gravité et depuis sa deuxième vers sa première position de repos sous l'effet de la différence de pression entre la partie de sortie (8), sous plus haute pression, et l'intérieur du boîtier de vanne (7), sous plus basse

pression, provoquée par l'écoulement au travers de la vanne, la pression dans la partie de sortie (8) agissant sur deux membranes séparées (12) et (13).

2. Dispositif pour mettre en oeuvre le procédé selon la revendication 1, caractérisé en ce qu'il comprend un boîtier de vanne (7) avec une partie de sortie (8), l'intérieur du boîtier (7) ainsi que l'intérieur de la partie de sortie (8) étant munie chacune d'une membrane respectivement (12) et (13) qui délimitent des chambres (14) et (15) communiquant respectivement via un conduit (16) et en ce que la membrane (12) est agencée pour pouvoir déplacer l'organe de vanne (10) dans une direction de fermeture vers un siège (11) dans le boîtier de vanne (7) en interrompant ainsi l'écoulement au travers.
3. Dispositif selon la revendication 2, caractérisé en ce qu'un dispositif de commande (17) est agencé pour commander l'écoulement au travers du conduit (16) qui à son tour détermine le temps de fermeture pour la vanne.
4. Dispositif selon la revendication 2, caractérisé en ce que la partie de sortie (8) est munie d'un épaulement intérieur (18) qui accentue l'augmentation de pression dans la partie de sortie (8).
5. Dispositif selon la revendication 2, caractérisé en ce que la partie de sortie (8) est terminée par un coude (9) qui dirige l'écoulement depuis la vanne et accentue aussi l'augmentation de pression dans la partie de sortie (9).

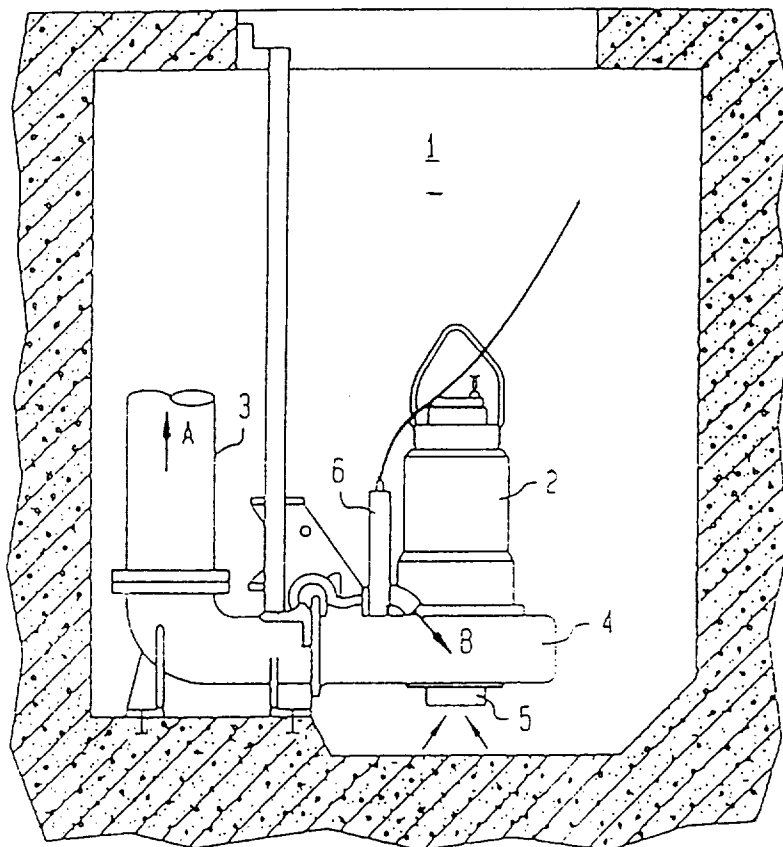


Fig 1

