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

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Description

The invention concerns a device and method for providing circulation in pump stations which are parts of a municipal sewage system.

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.

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.

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.

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

A solution that takes care of the above disadvantages is described in US-A-4948 342 (c.f. the preamble of claim 1). Here the valve is totally controlled by the pump pressure and no electricity is needed. However, subject valve is difficult to adjust for different closing times which is a necessity to make one and the same unit useful in different applications.

The purpose of this invention is to control the valve in a simple and reliable way and make it easily adjustable for different closing times. This is obtained by help of the device according to claim 1 and the method according to claim 5.

The invention is described more closely below with reference to the enclosed drawings.

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.

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. 9 stands for a valve ball and 10 its seat. 11 stands for a diaphragm, 12 a cup with an opening 13, 14 a bellows and 15 a connection line.

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.

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 wreching possible sludge banks. After a certain time, the valve is closed and the pumping takes place in the normal way.

The valve 6 comprises a valve housing 7 and an outlet nozzle 8. The housing 7 is provided with a valve cup 12 containing a diaphragm 11 with a valve ball 9. The latter is arranged to be able to close the cylinder formed part when it is pressed against its seat 10 in said housing 7.

In Fig 2 the valve is shown in open position which means that circulation takes place within the pump station. The valve ball 9 then takes a position entirely beside the flow, not hindering it. The flow through the housing 7 then quickly creates an under pressure which has an influence on the diaphragm 11 and this is utilized to obtain a closing of the valve after a certain time.

As the diaphragm is sealingly attached to the valve housing 7, the under pressure in the latter will urge the diaphragm 11 to move upwards into the housing 7, bringing the valve ball 9. Said movement of the diaphragm is, however, prevented by the fact that also the valve cup 12 is sealingly attached in the housing 7.

At the opposite side of the housing 7 a bellows 14 is arranged which is connected to an opening 13 in the valve cup 12 via a connection line 15. The bellows contains a medium, preferably oil, which via the connection line 15 and the opening 13 may be sucked into the space between the cup 12 and the diaphragm 11, thus allowing the latter to be moved upwards into the housing 7. The area of the opening 13 and the magnitude of the under-pressure in the valve 7 decide the speed of said movement. A simple control device connected to the opening 13 makes it possible to adjust the preferred closing time for the valve.

In Fig 3 is shown a position where the diaphragm and the ball are in progress to be moved into the flow in the housing 7. After a little while the ball 9 has been moved so far into the flow in the housing 7, that the flowing medium presses the ball against the seat 10, thus closing the valve. This is then kept closed as long as pumping takes place.

During this time the pump pressure prevails in the housing 7 which means that the diaphragm 11 is pressed back towards its initial position at a speed which is decided by the flow rate of the damping medium through the opening 13, back

into the bellows 14. Fig 4 shows the valve in a closed position when the diaphragm has reached its initial position. When the pumping is stopped, the pressure goes down and the ball reassumes the position shown in Fig 2, thus opening the valve before next pump start.

In the description above is referred to a valve ball which is heavier than the pumped medium and where the bellows and cup arrangement therefore is placed below the valve. The invention, however, also includes an embodiment where the ball has a density below that of the pumped medium and where therefore the diaphragm device is arranged above the valve and the ball comes to the surface for opening of the valve before next pump start.

According to a specific embodiment of the invention, an outer conduit is connected to the housing 7, where additives such as gas, chemicals etc can be sucked into the flow when the valve is open. This outer conduit may also be used for letting in air to delay or control the closing time at a simultaneous aeration of the pumped medium.

In the description the closing element is mentioned as a valve ball 9. The invention, however, also includes other movable or turnable means which may be used as closing elements.

According to the invention is obtained a very simple and reliable device for controlling of the mixing valve for primarily waste water pumping. The valve does not need any outer energy source and can be easily set for different opening times.

Claims

1. A device for obtaining circulation in a sewage pump water station (1) containing one or several pump units, preferably centrifugal pumps (2) of the submersible type, which device comprises mixing valves (6) connected to one or several of the pump units, which valves automatically during a certain limited period or periods connect the pressure side of a pump with the pump station (1) thus obtaining a circulation of the pumped medium and where the alternate return connection to the pump station is carried out by a valve comprising a connection to the pressure side of the pump and an outlet nozzle (8), where a valve cup (12) is sealingly attached to the valve housing (7) which cup contains a diaphragm (11) and a valve element (9), which, in dependence of the pressure situation in the valve housing (7), in its one rest position seals against a seat (10) in said housing thus closing the latter and which in its other rest position is contained in the valve cup (12) without hinderance to the flow through the valve (6) and that a bellows (14) is attached to the valve housing (7), which bel-

lows is connected to an opening in the valve cup (12) which allows medium to be exchanged between the bellows (14) and the space between the valve cup (12) and the diaphragm (11), characterized in that the bellows (14) is arranged on the housing (7) at a side opposite of the valve cup (12) and is connected to an opening (13) in the latter via a connection line (15) and a control device is connected to the opening (13) in the valve cup (12) to adjust the preferred closing time for the valve.

2. A device according to claim 1, characterized in that bellows (14) is filled with a damping medium such as oil.
3. A device according to claim 1, characterized in that the valve element (9) is a ball.
4. A device according to claim 1, characterized in that the valve (6) is provided with a connection for air intake for delaying or controlling the closing time.
5. A method for obtaining circulation in a sewage water pump station using the device of claim 1, characterized in that the control is obtained by help of a movable valve element (9), which in its closed position is pressed against its seat (10) by the pump pressure, and that the opening (13) may be controlled to adjust the speed of its movement.

Patentansprüche

1. Vorrichtung zum Erzielen einer Zirkulation in einer Abwasserpumpstation (1), die eine oder mehrere Pumpeneinheiten, vorzugsweise Zentrifugalpumpen (2) des tauchbaren Typs, enthält, mit Mischventilen (6), die mit einer oder mehreren Pumpeneinheiten verbunden sind und die während einer bestimmten begrenzten Periode oder Perioden die Druckseite einer Pumpe mit der Pumpstation (1) verbinden und dadurch eine Zirkulation des Pumpmediums erzielen, wobei die wechselweise Rücklaufverbindung mit der Pumpstation durch ein Ventil erfolgt, das eine Verbindung mit der Druckseite der Pumpe und eine Austrittsdüse (8) aufweist, wobei ein Ventilbecher (12) in abdichtender Weise an dem Ventilgehäuse (7) angebracht ist und eine Membran (11) und ein Ventilelement (9) enthält, das in Abhängigkeit von der Drucksituation in dem Ventilgehäuse (7) in seiner einen Ruhestellung dicht an einem Sitz (10) in dem Gehäuse anliegt und dadurch letzteres schließt und das in seiner anderen Ruhe-

stellung in dem Ventilbecher (12) enthalten ist und die Strömung durch das Ventil (6) nicht behindert, und wobei ein Balg (14) an dem Ventilgehäuse (7) angebracht ist und mit einer Öffnung in dem Ventilbecher (7) verbunden ist, die einen Austausch von Medium zwischen dem Balg (14) und dem Raum zwischen dem Ventilbecher (12) und der Membran (11) ermöglicht,

dadurch gekennzeichnet, daß der Balg (14) an einer dem Ventilbecher (12) entgegengesetzten Seite an dem Gehäuse (7) angeordnet ist und mit einer Öffnung (13) in dem Ventilbecher (12) über eine Verbindungsleitung (15) verbunden ist und eine Steuervorrichtung mit der Öffnung (13) in dem Ventilbecher (12) zum Einstellen der bevorzugten Schließzeit für das Ventil verbunden ist.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Balg (14) mit einem Dämpfungsmittel, wie Öl, gefüllt ist.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß es sich bei dem Ventilelement (9) um eine Kugel handelt.

4. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Ventil (6) mit einer Verbindung zum Einlassen von Luft zum Verzögern oder Steuern der Schließzeit versehen ist.

5. Verfahren zum Erzielen einer Zirkulation in einer Abwasserpumpstation unter Verwendung der Vorrichtung des Anspruchs 1, dadurch gekennzeichnet, daß die Steuerung mittels eines beweglichen Ventilelements (9) erzielt wird, das in seiner geschlossenen Stellung durch den Pumpendruck gegen seinen Sitz (10) gedrückt wird, und daß sich die Öffnung (13) zum Einstellen der Bewegungsgeschwindigkeit des Ventilelements steuern läßt.

Revendications

1. Dispositif pour réaliser la circulation dans une station (1) de pompage d'eaux d'égout contenant une ou plusieurs unités de pompes, de préférence des pompes centrifuges (2) du type submersible, ce dispositif comprenant des vannes de mélange (6) reliées à une ou plusieurs unités de pompes, ces vannes reliant, de manière automatique pendant une ou des périodes de temps limitées, le côté de refoulement d'une pompe avec la station de pompage (1), obtenant de cette manière une circulation du produit pompé et dans lequel la liaison de

retour alternée à la station de pompage est effectuée par une vanne comprenant une liaison au côté de refoulement de la pompe et une buse de sortie (8), dans lequel une coupelle de vanne (12) est fixée avec étanchéité au boîtier de vanne (7), ladite coupelle contenant un diaphragme (11) et un élément de vanne (9) qui, en fonction de l'état de la pression dans le boîtier de vanne (7), réalise, dans sa première position de repos, une étanchéité sur un siège (10) dans ledit boîtier fermant de ce fait ce dernier et qui dans son autre position de repos est contenu dans la coupelle de vanne (12) sans faire d'obstacle au flux circulant à travers la vanne et un soufflet (14) étant fixé au boîtier de vanne (7), ledit soufflet étant relié à une ouverture dans la coupelle de vanne (12) qui permet au produit de passer entre le soufflet (14) et l'espace entre la coupelle de vanne (12) et le diaphragme (11), caractérisé en ce que le soufflet (14) est disposé sur le boîtier (7) sur un côté opposé à la coupelle de vanne (12) et est relié à une ouverture (13) de cette dernière par l'intermédiaire d'une canalisation de liaison (15) et un dispositif de commande est relié à l'ouverture (13) dans la coupelle de vanne (12) de manière à régler le temps de fermeture préféré de la vanne.

2. Dispositif selon la revendication 1, caractérisé en ce que le soufflet (14) est rempli d'un produit d'amortissement tel que de l'huile.

3. Dispositif selon la revendication 1, caractérisé en ce que l'élément de vanne est une bille.

4. Dispositif selon la revendication 1, caractérisé en ce que la vanne (6) est munie d'une liaison pour une entrée d'air pour retarder ou commander le temps d'ouverture.

5. Procédé pour réaliser la circulation dans une station de pompage d'eaux d'égout utilisant le dispositif de la revendication 1, caractérisé en ce que la commande est obtenue à l'aide d'un élément de vanne mobile (9) qui, dans sa position de fermeture, est pressé contre son siège (10) par la pression de la pompe et en ce que l'ouverture (13) peut être commandée pour régler la vitesse de son mouvement.

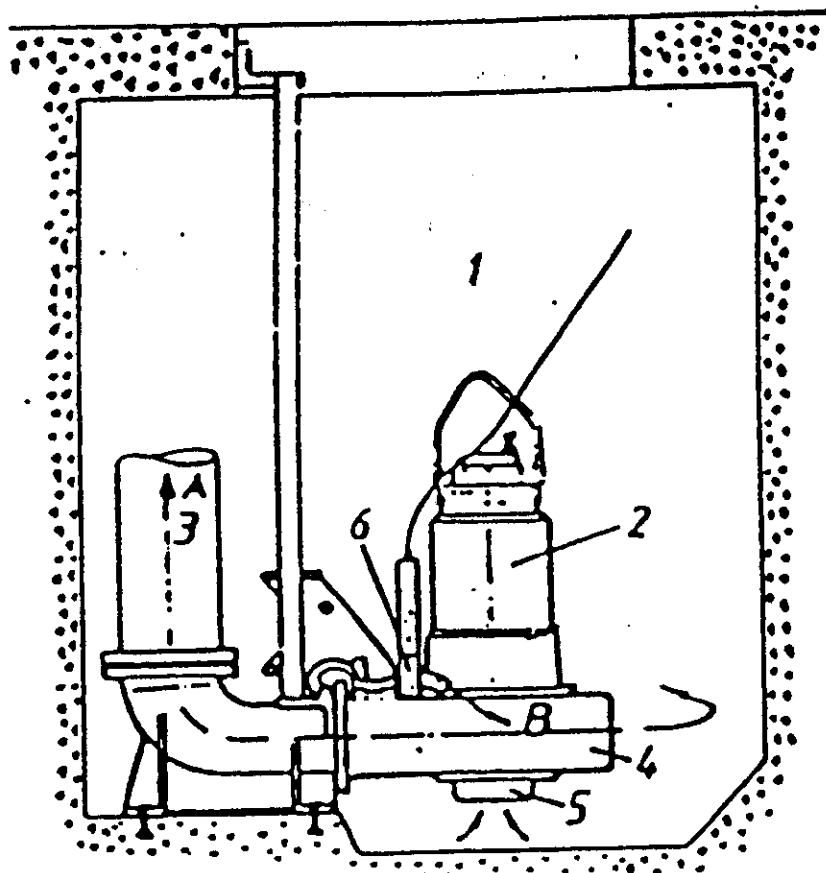


Fig. 1

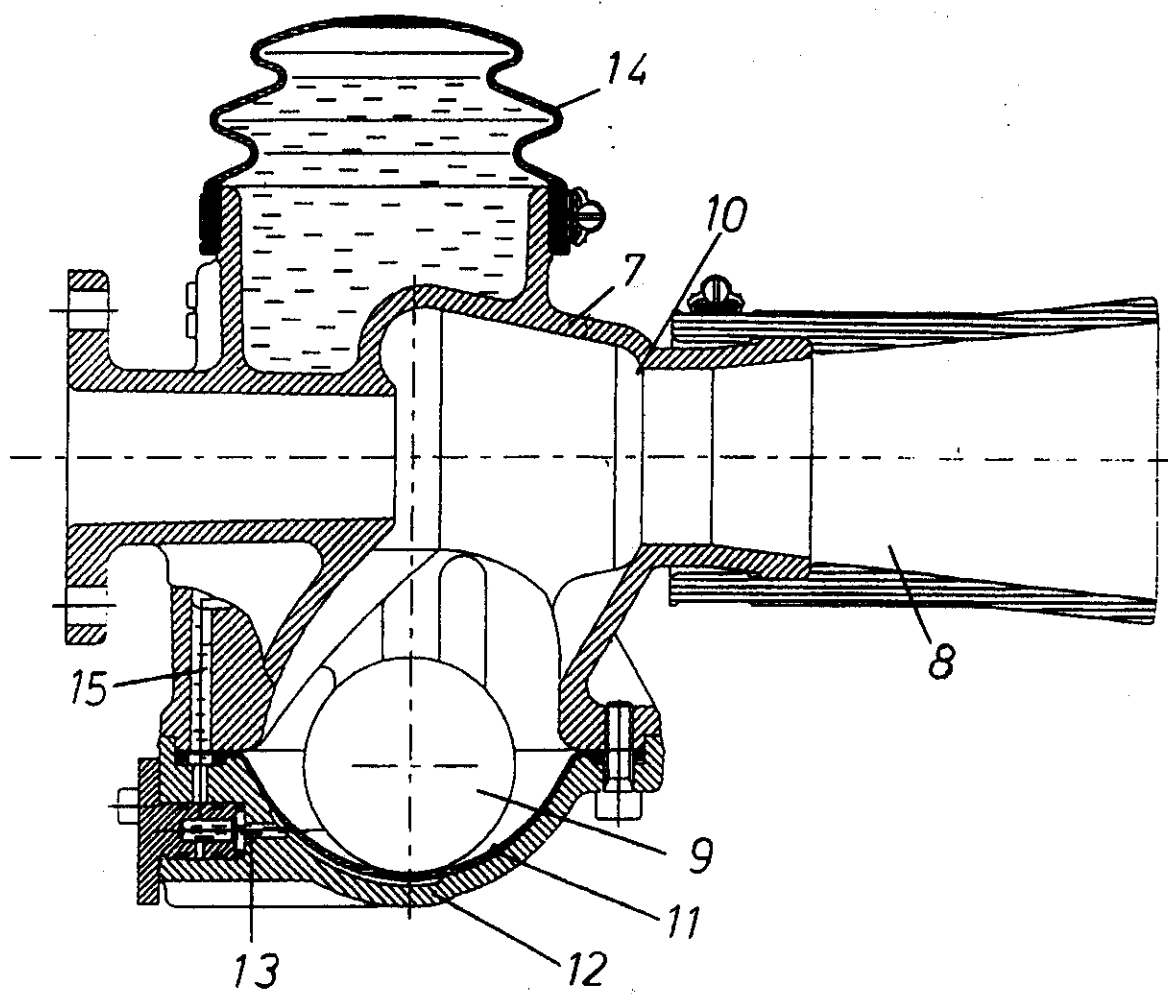


Fig.2

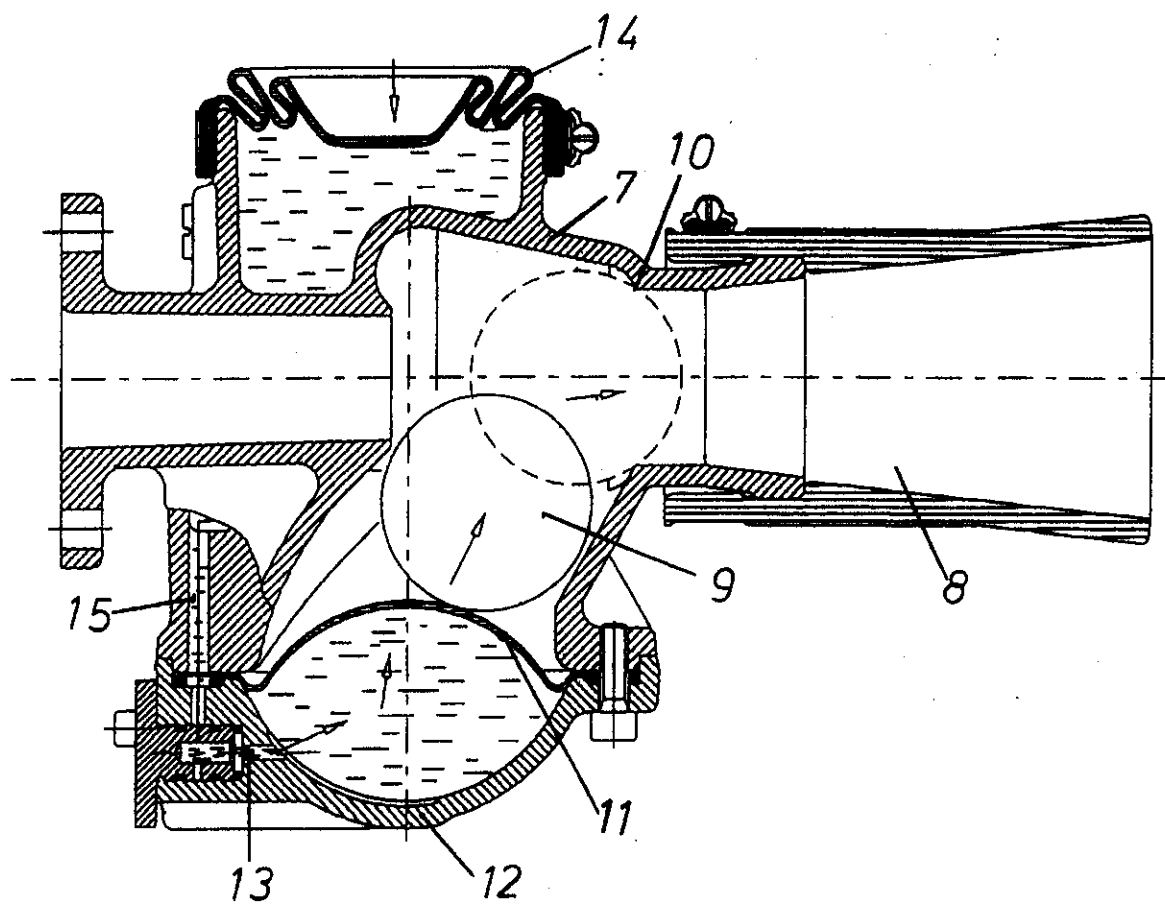


Fig. 3

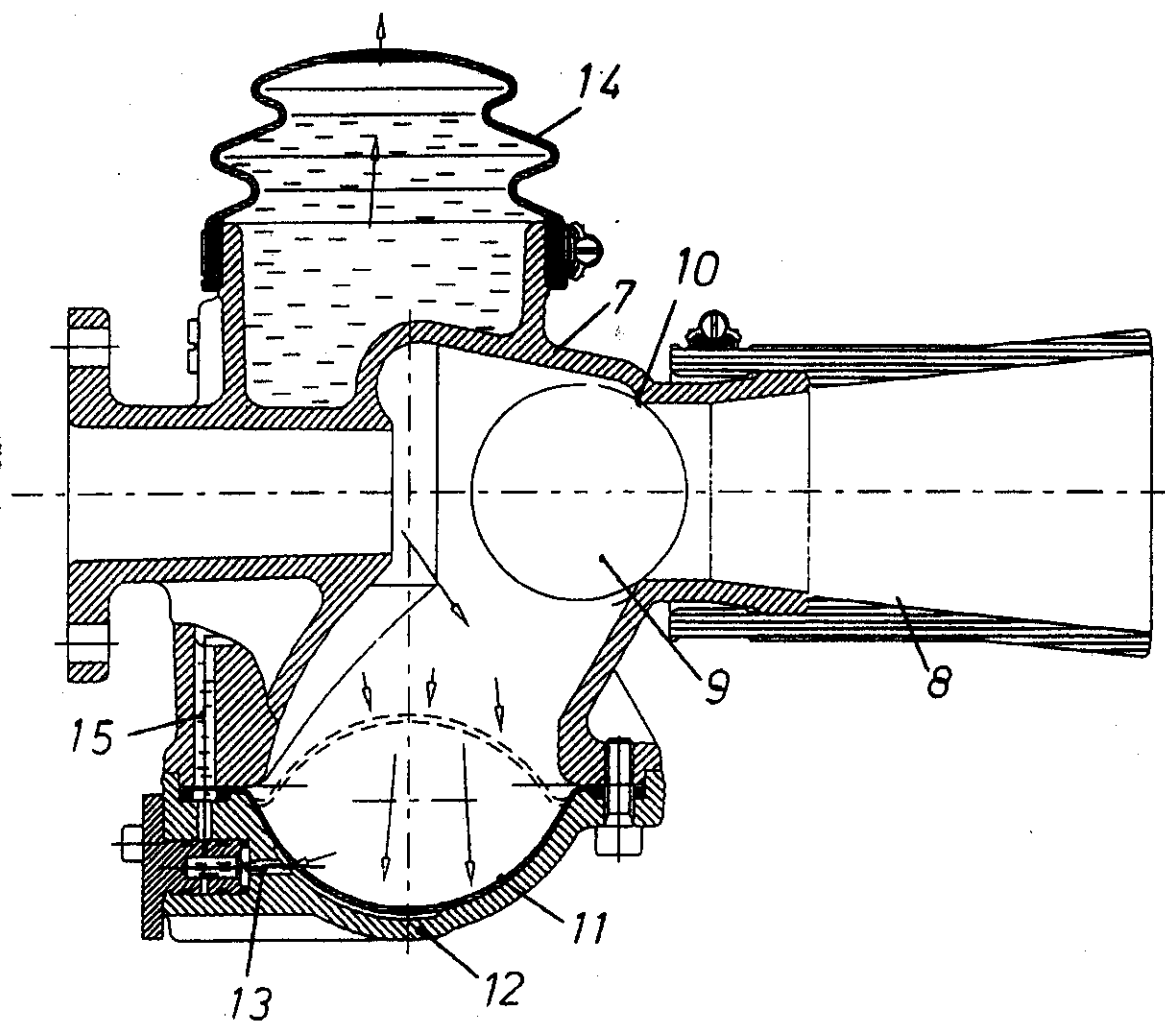


Fig4

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