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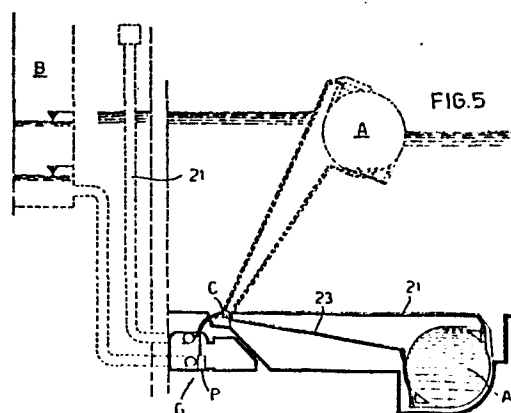
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54 Hinged sluice gate with displacement of mass.

57 The sluice gate proposed in this patent application is fixed at one of its ends using a hinge (C) and comprises a chamber (A) containing a fluid lighter than the liquid in which said sluice gate is used. Provision is made inside the sluice gate for displacing a mass which moves the sluice gate's center of gravity towards or away from the hinge (C), so that the value of the moment varies produced by said sluice gate's mass, opposed to the moment produced by buoyancy, in this way varying the sluice gate's angular position.



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"HINGED SLUICE GATE WITH DISPLACEMENT OF MASS"

- This present invention refers to moving sluice gates of fan type which rotate for an angle not exceeding 90° and can be used for creating a difference in level in a dock or course of water or other kind of liquid. Said sluice gates are normally made up
5. (US-A-3 756 032) of a series of bodies arranged side by side, which are fitted in the dock or watercourse to be regulated using a hinge on which they swivel. The position in the water of these sluice gates is defined by the equilibrium of the moments around said hinge, moments which are produced by the sluice gate's own
10. weight, buoyancy and any other forces exerted from the outside.

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- The drawbacks inherent in these sluice gates are the result of the necessity to provide a complicated and costly system of producing, distributing and regulating the compressed air needed for the functioning of said sluice gates, in order to fill the
5. chambers to obtain buoyancy. Furthermore the known solutions provide the direct communication through at least an opening provided in the sluice gate between the inside of the same sluice gate and the liquid in which it is immersed. This does not allow the use of a liquid other than the one in which the sluice gate
10. is immersed. Finally the variation of moments is obtained by means of a compressor which sends compressed air inside the sluice gate, thus causing the exit of water. Therefore, it is impossible to rise the water level inside the sluice gate above the sea, river or lake level in which the sluice gate is
15. immersed. This causes disadvantages while lowering the sluice gate if negative level differences are present. Furthermore the known solution requires considerable power.

- G.B. A 1 479 300 is also known. It discloses a sluice gate rotating for an arc exceeding 90° around a hinge, said sluice
20. gate being provided with two buoyancy tanks which are filled with water and emptied. The water contained in the two tanks is not exclusively exchanged between them, but is successively exited from one or the other chamber.

- More than one operation is necessary when using this solution:
25. firstly one chamber is emptied, then the other, whereupon the

first chamber is filled again; furthermore the sluice gate is supported by beams or thrust bearing props.

- Furthermore, when the dock is in a closed condition the upper or outermost chamber contained in the sluice gate, with respect to
5. the hinge, must be partially full so as to eliminate the Archimedean thrust making the sluice gate rest on the prop.

- Therefore, the object of this invention is to provide a rotating sluice gate which can be rotated for an angle not exceeding 90° having economical advantages both during installation and
10. working. Further its manufacture and maintenance are easy. Said sluice gate has high reliability and requests limited power.

The above-mentioned object has been realized with the device described in the accompanying claims.

- This invention will now be described in more detail using some
15. exemplary embodiments shown in the accompanying drawings, in which:

Fig. 1 is a sectional side view of a sluice gate shown in two working positions, according to the invention;

- Figs. 2, 3 and 4 are views of further examples of embodiment,
20. according to the invention;

Fig. 5 is a side view of a further embodiment in which a rigid mass is displaced, according to the invention;

Fig. 6 is a partial sectional side view of a further embodiment, according to the invention.

Fig. 1 shows a sluice gate element 10 fixed to the bottom of a dock by means of the hinge C. Element 10 has two chambers A and B, chamber A being the outer and chamber B the inner one, that is, closer to hinge C. The two chambers A and B are connected by pipes in such a way that they can contain air (or other fluid having smaller gravity), water (or other liquid having gravity greater than the fluid mentioned above) alternatively, thus forming the movable mass which produces moments of different value around hinge C. This allows the sluice gate to rise when the moment produced by buoyancy becomes greater than the moment produced by the movable mass and the sluice gate's own mass. In this case the sluice gate moves to the raised position 10' shown in fig. 1. As can be seen the sluice gate is fitted with a reversible pump P and pipes 21 which connect the tops of both chambers A and B; the pump P is connected to the bottom of both chambers A and B by pipes 23. When not in use liquid can be transferred through the pump to equalize the levels in the two chambers. If this is inconvenient, pump P's piping may be fitted with suitable devices, such as solenoid valves E. A normal unidirectional pump with pipes and valves obviously can be used instead of the reversible pump.

It is also possible to use two nonreversible pumps P1 and P2 (fig. 2), one of which pumps the liquid from chamber A to chamber B, while the other pumps in the opposite direction from chamber B

to chamber A. Both of these said pumps can be fitted with a simple nonreturn valve. This latter solution using two pumps prevents water from flowing back into the empty chamber B, even when the sluice gate is not in use.

5. The sluice gate can be made up of several bodies placed side by side and joined together. In this case, moreover, the corresponding chambers B and the corresponding chambers A can be hydraulically connected to one another at the bottom. This would allow use of a smaller number of pumps than number of elements
10. and ensure that one pump can act as active backup to another.

- Fig. 3 represents a further solution, in which pumps P are installed in an operating gallery G to simplify maintenance and replacement. Obviously in this case the pipes coming from the two chambers A and B would have to reach as far as pump P, with the
15. necessary connections being made to allow the sluice gate to have angular movement.

- It is also possible to realize chamber B so that all or part of it is fixed and external to the sluice gate (Fig. 4) and connected with buoyancy chamber A so as to exchange the water by
20. means of a pipe 23 which connects through pump P the bottom of the two chambers: A provided inside and B outside the sluice gate. In this case the communication for the exchange of the air between the upper part of the two chambers occurs by means of pipe 21 which ends in the atmosphere, due to the fact that the

fixed chamber B is in direct communication with the atmosphere. In this case the liquid to be used for moving the sluice gate can be different from the one in which the sluice gate is immersed; in particular it can be a treated liquid, for example antifouling and anticorrosive.

5.

If this possibility is not taken into consideration, the chamber B can be the same dock.

Fig. 5 shows a solution quite similar to the one of fig. 4 in which however the geometry of the sluice gate is different. The operation is quite similar to what already disclosed with reference to fig. 4.

10.

For the movable mass a solid body S can also be used (Fig. 6), which moves along the length of the sluice gate from the hinge C to the outer end and viceversa, while the volume of chamber D, on which the buoyancy acts partially or totally, remains unchanged.

15.

The body S can be moved, for example, by a motor 24 which turns a worm screw 25 engaged to said body S or with oleodynamic system or others. The body S can be either inside or outside the chamber D, as shown in the figure. In a further embodiment the movable mass can be partly solid and partly liquid, as mentioned above, thus combining the moments due to the solid body to the displacement of the fluid.

20.

In Fig. 7 a further solution is shown in which hinge C, to which the moving sluice gate is fixed, is placed above the level of a

watercourse. Thus sluice gate 20 assumes a more or less slanting position depending on the horizontal distance $\underline{d}$ of body S from hinge C however, in this case the movable mass may also be composed of a liquid, like that described above in reference to

5. figures 1 to 5.

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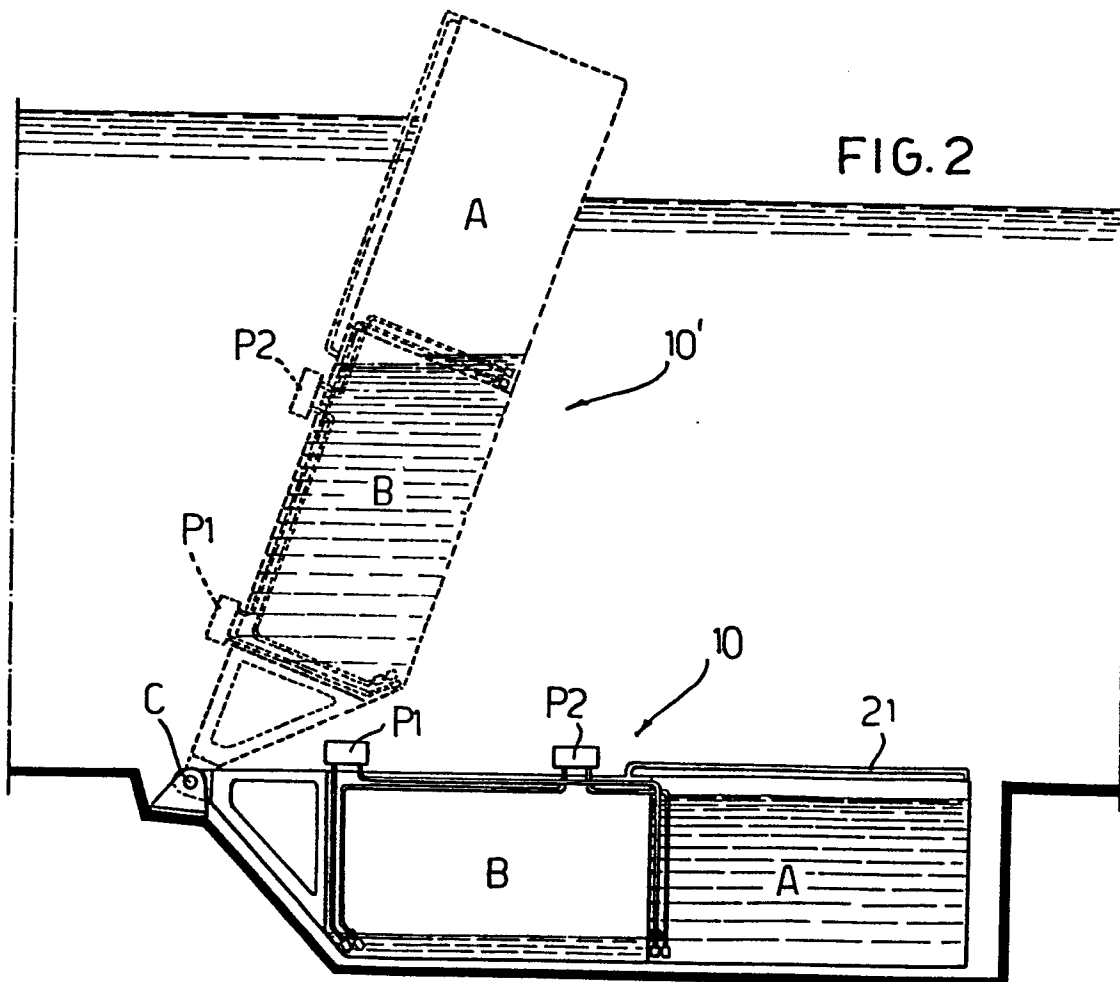
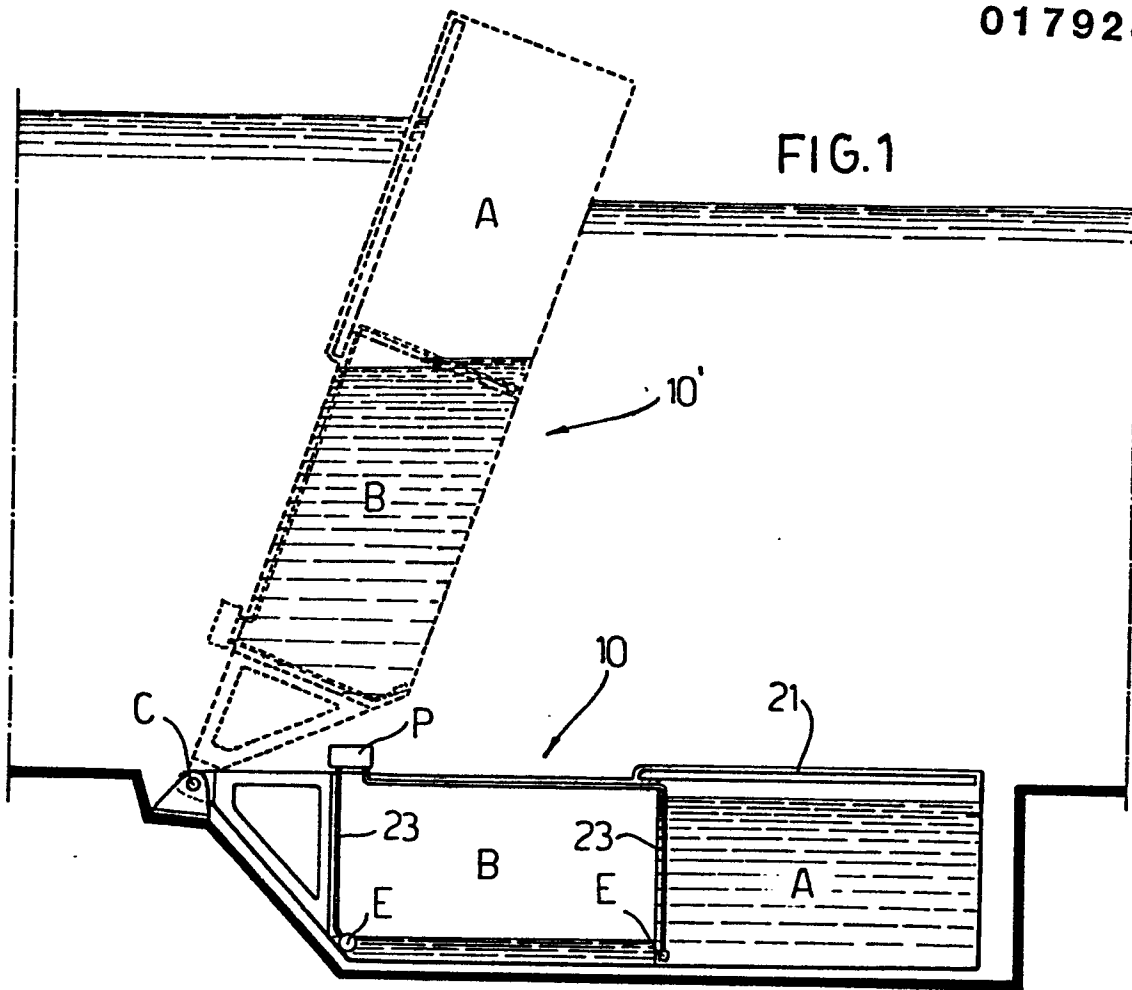
1. A sluice gate suitable for creating a difference in level in a dock or course of water or other kind of liquid, fixed at one end using a hinge (C) on which it swivels moving its barycenter during the rotation of an angle not exceeding 90° and
5. comprising a chamber (A) containing air or water alternatively, which allows buoyancy to act on said sluice gate when it is at least partially immersed in a liquid; characterized in that provision is made for a movable liquid or solid mass and that this mass is displaced within a closed circuit towards and away
10. from the hinge (C).
2. A sluice gate according to claim 1, characterized in that the movable mass is a liquid contained in a second chamber (B) connected to the first by pipes (21, 23) and a means is provided for displacing the liquid from one chamber (A, B) to the
15. other.
3. A sluice gate according to claim 2, characterized in

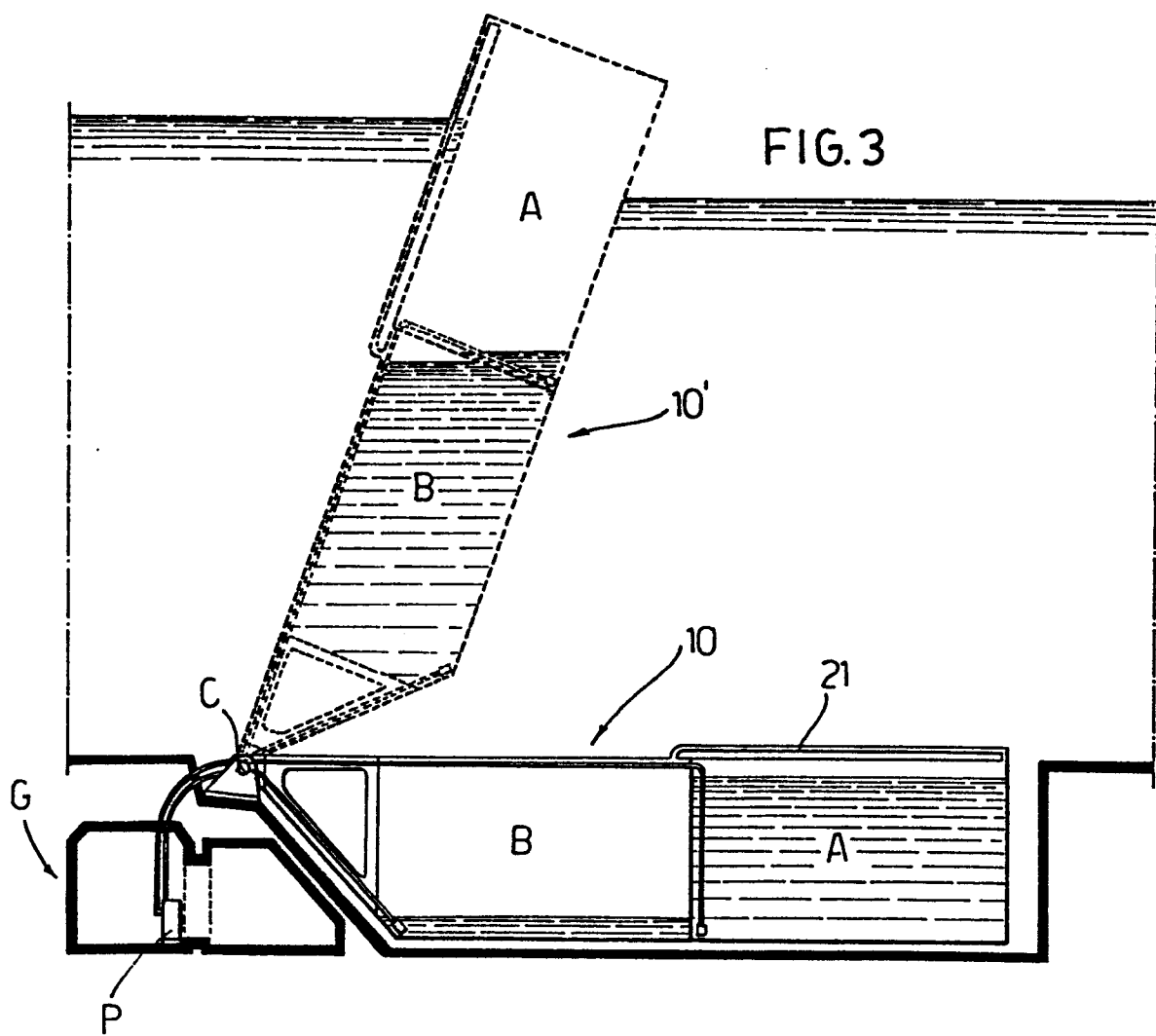
that the shifting means is a reversible pump (P).

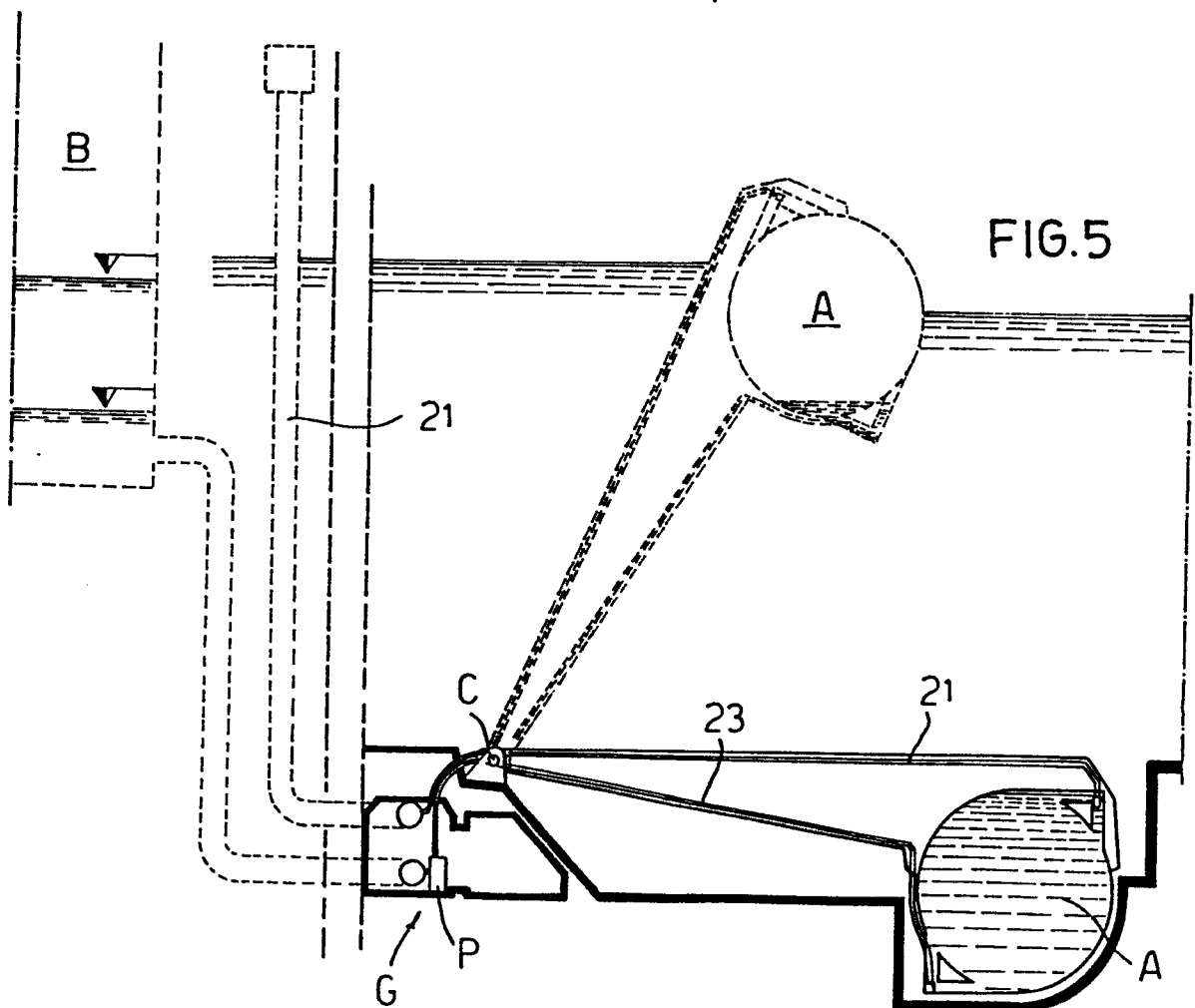
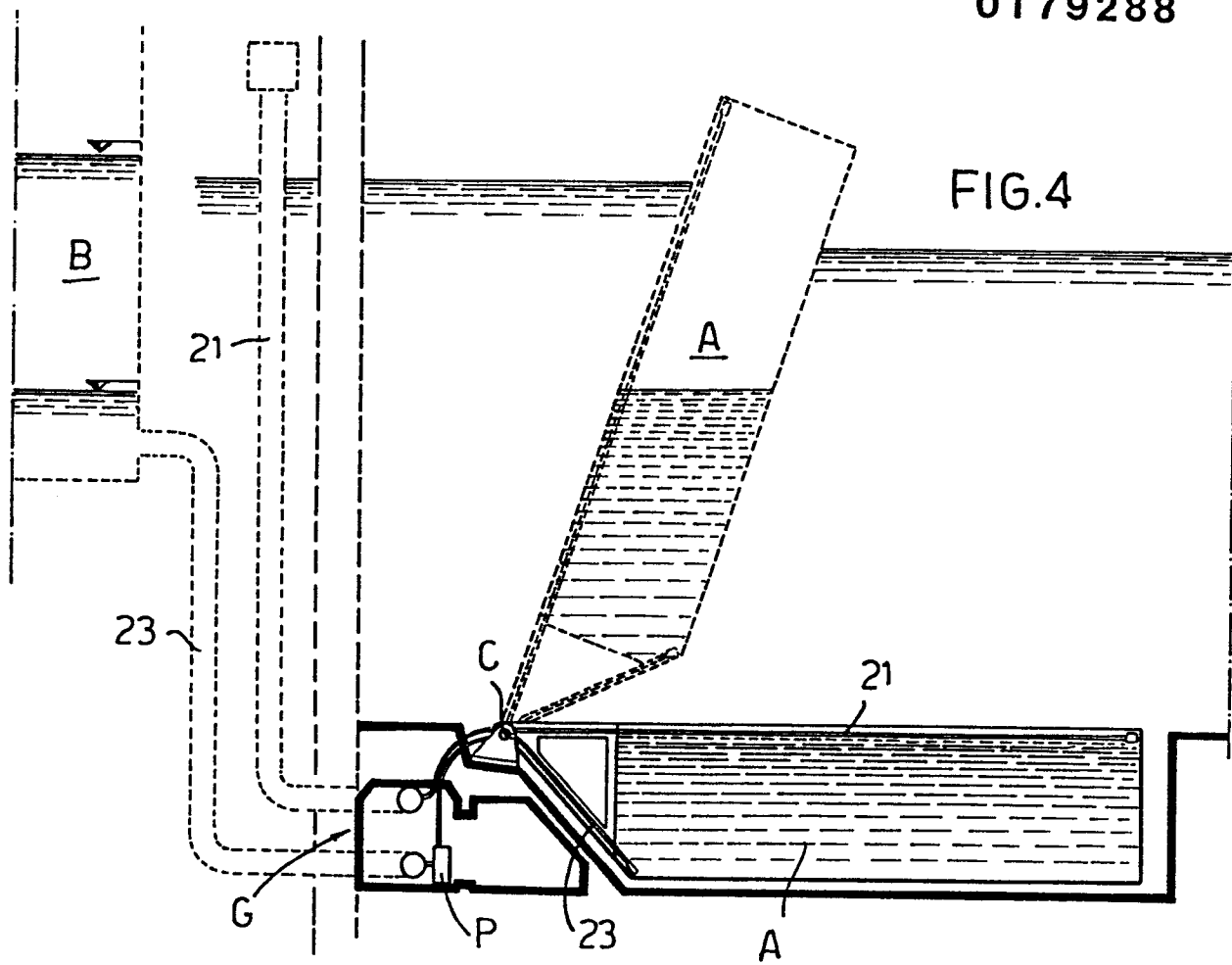
4. A sluice gate according to claim 3, characterized in that solenoid valves (E) or similar are also provided for intercepting the liquid which flows into and/or out of the pump
5. (P).
5. A sluice gate according to claim 1, characterized in that the pump (P) is unidirectional and a valve and pipe system for the backflow is provided
6. A sluice gate according to claim 2, characterized in
10. that the pumps are two nonreversible pumps (P1, P2), one of which sends the liquid from the first (A) to the second chamber (B), whereas the other sends the liquid in the opposite direction.
7. A sluice gate according to claim 6, characterized in that nonreturn valves are also provided which are inserted in the
15. suction pipe of each nonreversible pump.
8. A sluice gate according to claim 2, characterized in that the second chamber (B) or part of it is fixed and external to the sluice gate, said second chamber being connected to the first by pipes (21, 23) forming a circuit for the exchange of
20. liquid.
9. A sluice gate according to claim 1, characterized in

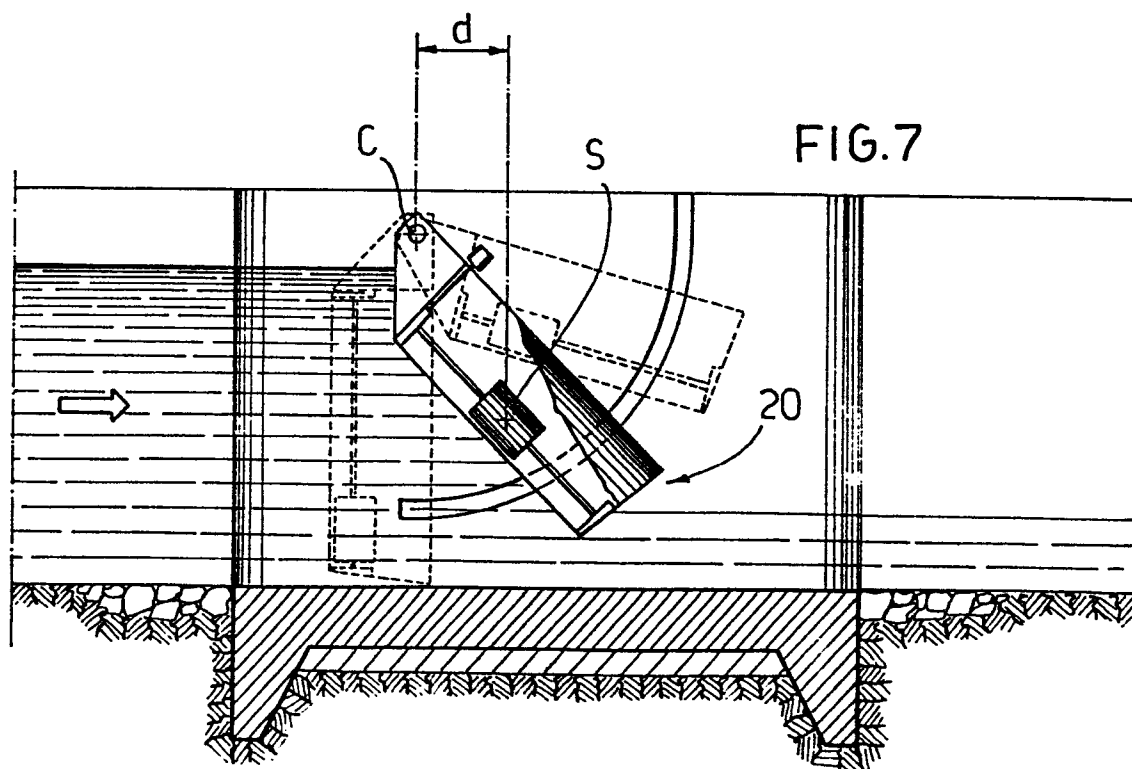
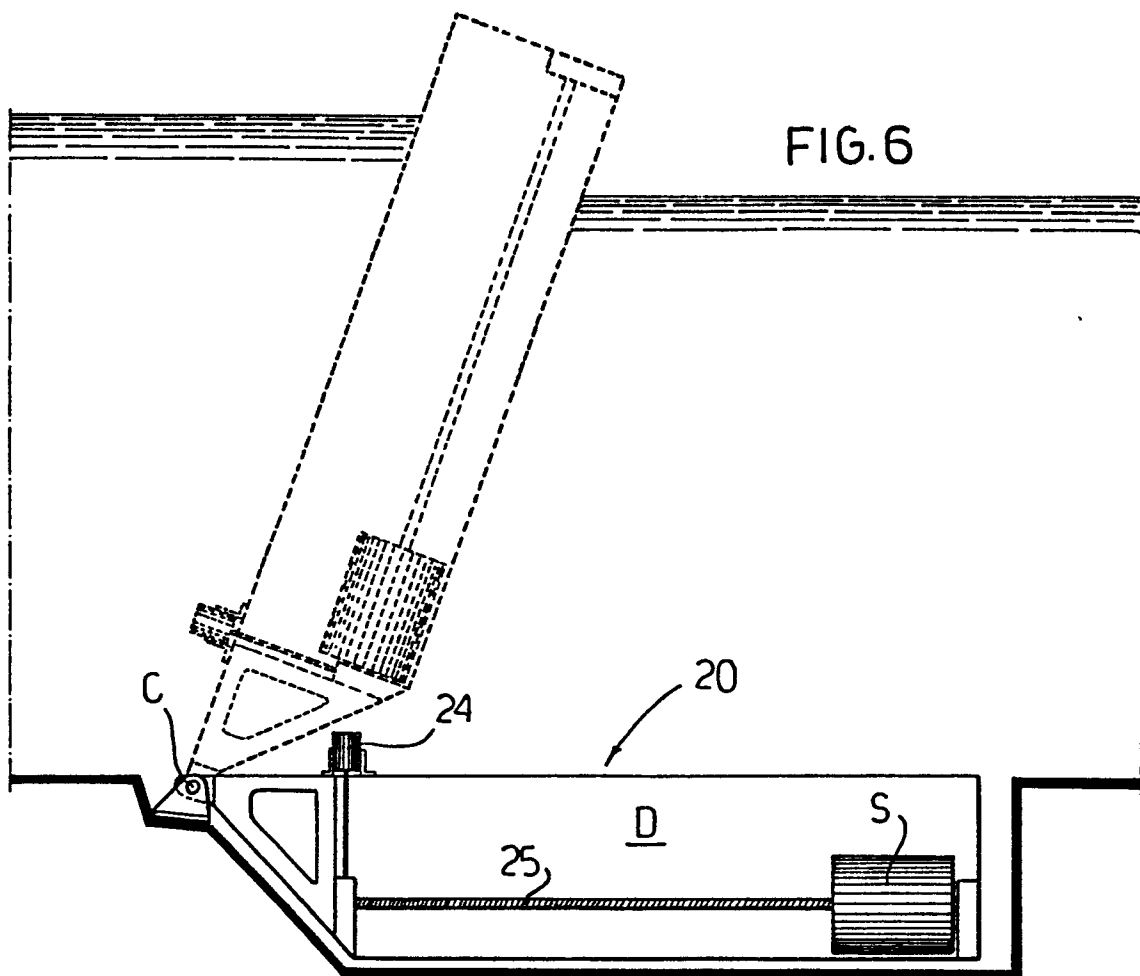
that the movable mass is a solid object (S) which is displaced along the sluice gate.

10. A sluice gate according to claim 1, characterized in that the hinge (C) is placed above the level of the dock or
5. watercourse.











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. 4)
X	GB-A-1 479 300 (TAYLOR WOODROW INTERNATIONAL LTD.) * Page 2, lines 4-43; figures 4A-4C *	1,2	E 02 B 7/44
Y		10	
Y	US-A-3 756 032 (SOLINAS) * Column 2, lines 44-68; column 3, figures 2-7 *	10	
A		1	
A	DE-C- 65 252 (HEYN) * Page 1, column 2, lines 16-26; figure 2 *	1,9	
A	CH-A- 337 152 (BUSS)		E 02 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 07-01-1986	Examiner HANNAART J.P.
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			