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(54) Float valve, float flood gate and method of use thereof

(57) The present invention provides a device for causing a difference, in a ratio determined in advance and/or subsequently, in liquid level between a first position, with associated first difference in liquid level, and a second position, with an associated second difference in liquid level, comprising:

- a framework in which at least one opening is arranged;
- valve means arranged in the opening for at least partial closing thereof.

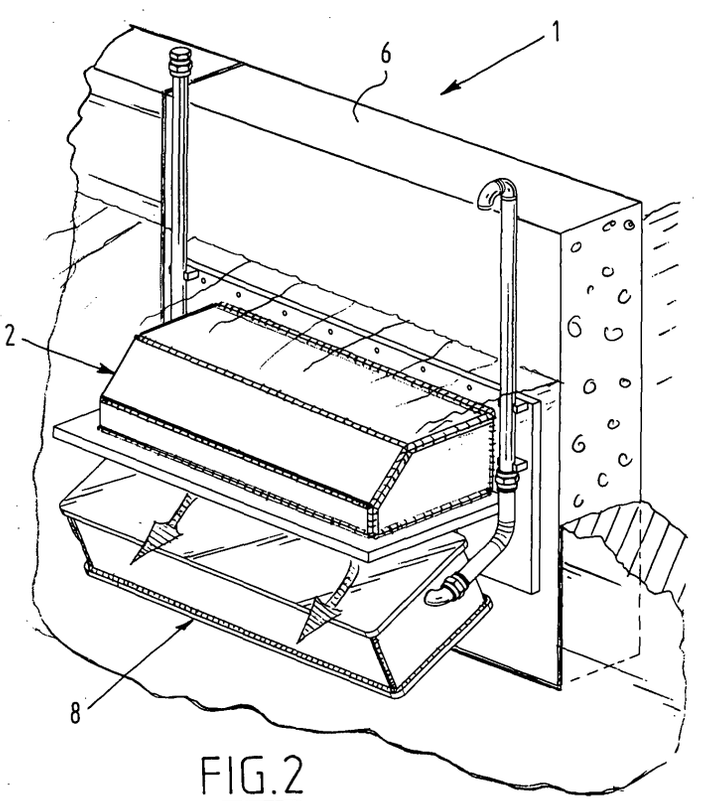

FIG.2

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Description

[0001] The present invention relates to a device for maintaining a difference in water height and/or difference in level, and a method for use thereof.

[0002] The invention has for its object to provide a non-motorized device with which a difference in water level can be maintained.

[0003] The invention provides for this purpose a device for causing a difference, in a predetermined ratio, in liquid level between a first position, with associated first difference in liquid level, and a second position, with an associated second difference in liquid level, comprising:

- a framework in which at least one opening is arranged;
- valve means arranged in the opening for at least partial or full closing thereof.

[0004] The device according to the invention maintains a predetermined difference in liquid level between two sides of a barrier. With the device according to the invention a ratio in liquid levels desired by a water company or a farmer can be adjusted between for instance plots for cattle farming, arable farming or market gardening, also referred to as agriculture, and/or urban areas.

[0005] In a preferred embodiment the device comprises adjusting means coupled to the valve means for adjusting the predetermined ratio of the difference in liquid levels.

[0006] In a further preferred embodiment the adjusting means comprise one or more float members, the buoyant force of which is adjustable. The buoyancy is thus used to cause or maintain a difference in level.

[0007] In a further preferred embodiment the location where the adjusting means are coupled to the valve means is displaceable so as to vary the buoyant force. Such a construction is robust and can be adjusted easily.

[0008] In a further preferred embodiment the adjusting means are coupled to the valve means with one or more hinges. An upper level thus rises in a roughly constant, linear or logarithmic ratio relative to a lower level.

[0009] In a further preferred embodiment the adjusting means are coupled to the valve means via one or more rods. An upper level thus rises in a roughly constant, linear or logarithmic ratio relative to a lower level.

[0010] In a further preferred embodiment the device comprises one or more ballasts for damping vibrations.

[0011] In a further preferred embodiment the valve means and/or the float members are of plastic, metal or wood. These materials are found to have sufficient durability and strength.

[0012] In a further preferred embodiment a float member is arranged pivotally under the framework. Such a device combines a relatively large flow rate with relatively small dimensions by making use of the available difference in level.

[0013] Further advantages and features of the invention will be elucidated with reference to the annexed figures, in which:

- Fig. 1 shows a perspective view of a device according to the invention in a first preferred embodiment;
- Fig. 2 shows a perspective view of the device of fig. 1 in a second situation of use;
- Fig. 3 shows a cross-section in side view of the device of fig. 1 in a first situation of use;
- Fig. 4 shows a cross-section in side view of the device of fig. 1 in a second situation of use;
- Fig. 5 shows a perspective view of a device according to the invention in a second preferred embodiment;
- Fig. 6a-6c show a cross-section in side view of the device of fig. 5 in three successive situations of use, varying from a first extreme position in fig. 6a to a second extreme position in fig. 6c;
- Fig. 7a-7c show a cross-section in side view of the device of fig. 5 in a third preferred embodiment in three situations of use varying between two extreme positions.

[0014] A first preferred embodiment of a device 1 according to the present invention relates to a so-called float valve 1, comprising a substantially block-like elongate housing 2 provided with an opening 22 in the underside and an opening 26 in the rear side which communicate which each other for the passage of liquid. The rear side of the housing is coupled to a plate-like member 4 with corresponding opening 26 for fixing the housing therewith to a water-retaining structure 6 between two areas of differing level in which a corresponding opening 28 is likewise arranged for passage of liquid. Arranged on the underside of housing 2 are hinged valve means, comprising in the shown embodiment a substantially beam-shaped hollow floating body 8 for closing therewith the opening or openings in the underside of housing 2 when a desired difference in liquid level has been reached or this liquid level falls below the desired difference, and for leaving this opening or openings clear when the predetermined difference in liquid level is exceeded, both in the case the upper surface 10 rises above a determined level and the lower surface 12 falls below a determined level.

[0015] Float valve 1 is fixed to the water-retaining structure 6 under liquid level 12, wherein pipes 14 and 16 protrude at one end above the liquid and are connected at the other end to floating body 8. Via pipe 14 a suitable liquid can be carried into floating body 8 by allowing a liquid to flow in via coupling piece 15, for instance using an external pump, or for removing liquid therefrom wherein tube 16 with curved upper part 18 provides the required venting and bleeding. The buoyancy of floating body 8 can thus be adapted to maintain

a desired difference 20 which can be established for a shorter or longer period on either side thereof with relatively simple means (fig. 1, 2, 3 and 4).

[0016] In a state of equilibrium, wherein the level difference 20 set in the above stated manner is reached, floating body 8 closes, due to the buoyancy thereof, the opening 22 in the underside of housing 2 preferably provided with a rubber profile 24 for sealing (fig. 3). If the level difference 20 is exceeded, i.e. if either the upper level 10 becomes too high or the lower level 12 too low, floating body 8 is pressed downward by the increased water pressure, i.e. the float loses buoyancy, so that opening 22 is left clear for the passage of water, which flows in the direction of the arrow (fig. 4). This figure also shows clearly that the opening 26 in the rear of housing 2 communicates with opening 28 in the water-retaining structure 6. The figures are two-dimensional representations of a three-dimensional product.

[0017] A second embodiment according to the present invention (fig. 5) relates to a so-called floodgate valve 50 which is arranged in opening 52 in a water-retaining structure. Floodgate valve 50 comprises plates 54 which are arranged symmetrically in relation to each other in the water-retaining structure and which are L-shaped in top view for pivotal connection thereto of a plate 56, on both sides of which are arranged plates 58 of quarter-circle shape between which a ballast 60 is arranged at an angle of about 90° to pivot axis 62 relative to plate 56. Arranged on both sides of plate 56 are floating bodies 64 which are rotatably connected to plate 56 at a predetermined location 66. A ballast 68 is arranged on the bottom of floating bodies 64 in order to damp undesirable movements, such as movement to and fro of the float members (fig. 5, 6a).

[0018] The lowest reference level at which the floodgate valve 50 functions is determined by the height of pivot point 62, wherein the opening 52 in the water-retaining structure under pivot point 62 is closed by wall 70. In this situation of use the level 72 on one side of floodgate valve 50 is the same as level 74 on the other side (fig. 6a). When level 74 rises, the floating bodies 64 will also rise due to their buoyancy, so that plate 56 moves into an inclining position relative to water-retaining structure 54, wherein the outer end 76 of plate 56 protrudes above the level 74. Plate 56 acts here as an overflow, wherein as higher level the level 72 reaches the position of outer end 76 (fig. 6b). The extreme value of this rise is related to the position at which level 74 has risen such that plate 56 comes to lie in a vertical or almost vertical position (fig. 6c), wherein level 72 also reaches the maximum range of adjustment. Between the extreme positions shown in fig. 6a and fig. 6c the floodgate valve ensures that level 72 rises in a determined ratio relative to level 74, determined by the location of connection 66 to plate 56. Location 66 can be chosen such that the ratio in which the liquid levels 72 and 74 rise in relation to each other is roughly constant, assuming a starting position wherein the both levels are the same as shown in fig. 6a. This is of particular importance when areas of differing level are compartmentalized in the Westland (NL), wherein a desired reference level can be set per area of differing level.

[0019] In a third embodiment (fig. 7a, 7b, 7c) corresponding components have the same reference numerals as in the above described second embodiment. The float members 64 are in a higher position relative to water level 74 since ballasts on the floating bodies have been omitted. Floating bodies 64 are connected via rods 76, 78 and 80 at location 66 to plate 56 and are also pivotally connected to water-retaining structure 70 at point 82.

[0020] The operation of the third embodiment corresponds for a greater part to the operation of the second embodiment, wherein however, due to the predetermined ratio of the length of rods 76, 78, 80, the ratio of the rise in level 72 relative to level 74 can be substantially constant, linear or logarithmic. Ballast 60 provides the desired damping. There is a greater freedom of adjustment here due to the variation in the length of rods 76, 78, 80 and the location and size of the ballast, whereby the different constant, linear or logarithmic ratios are among the possibilities.

[0021] The present invention is not limited to the above described preferred embodiments, in which many modifications can be envisaged; the protection sought is defined by the scope of the appended claims.

Claims

1. Device for causing a difference in liquid level, in a ratio determined in advance and/or subsequently, between a first position, with associated first difference in liquid level, and a second position, with an associated second difference in liquid level, comprising:
   - a framework in which at least one opening is arranged;
   - valve means arranged in the opening for at least partial closing thereof.

2. Device as claimed in claim 1, comprising adjusting means coupled to the valve means for adjusting the ratio, determined in advance and/or subsequently, of the difference in liquid level.

3. Device as claimed in claim 2, wherein the adjusting means comprise one or more float members, the buoyant force of which is adjustable.

4. Device as claimed in claim 2 or 3, wherein the location where the adjusting means are coupled to the valve means is displaceable so as to vary the buoyant force.

5. Device as claimed in any of the claims 2-4, wherein the adjusting means are coupled to the valve means with one or more hinges.

6. Device as claimed in any of the claims 2-5, wherein the adjusting means are coupled to the valve means via one or more rods.

7. Device as claimed in any of the claims 2-6, also comprising one or more ballasts for damping vibrations and/or balancing the valve means.

8. Device as claimed in any of the claims 2-7, wherein the adjusting means comprise one or more hollow pipes which are connected to the float member for modifying a quantity of water therein so as to adjust the buoyant force thereof.

9. Device as claimed in any of the foregoing claims, wherein the valve means are of plastic, metal or wood.

10. Device as claimed in any of the foregoing claims, wherein the float member is of plastic, metal or wood.

11. Device as claimed in any of the claims 1-5, wherein a width of the valve means lies in the range of 0.1 to 30 m.

12. Device as claimed in any of the claims 1-11, wherein the predetermined ratio is roughly constant.

13. Device as claimed in any of the claims 1-11, wherein the predetermined ratio is roughly linear.

14. Device as claimed in any of the claims 1-11, wherein the predetermined ratio is roughly logarithmic.

15. Device as claimed in any of the claims 1-12, wherein a float member is arranged pivotally under the framework.

16. Device as claimed in any of the claims 1-12, wherein a float member is arranged in translating manner under the framework.

17. Method for maintaining a difference in water height or level using a device as claimed in any of the claims 1-16.

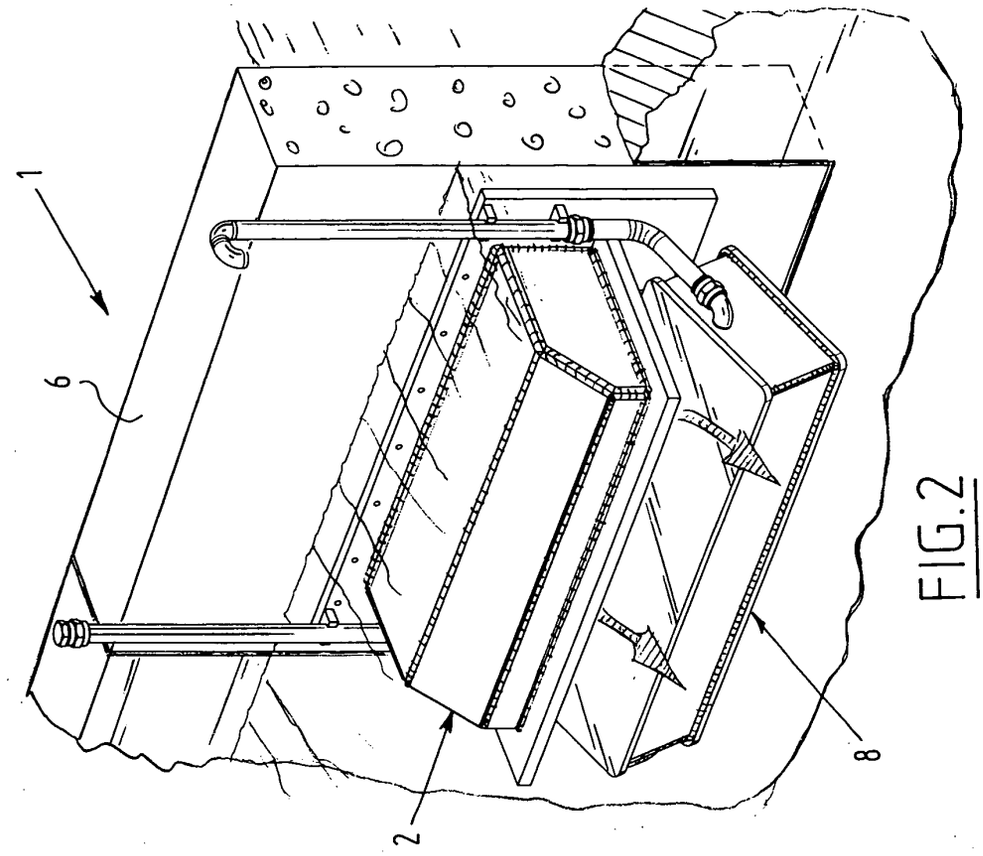

FIG.2

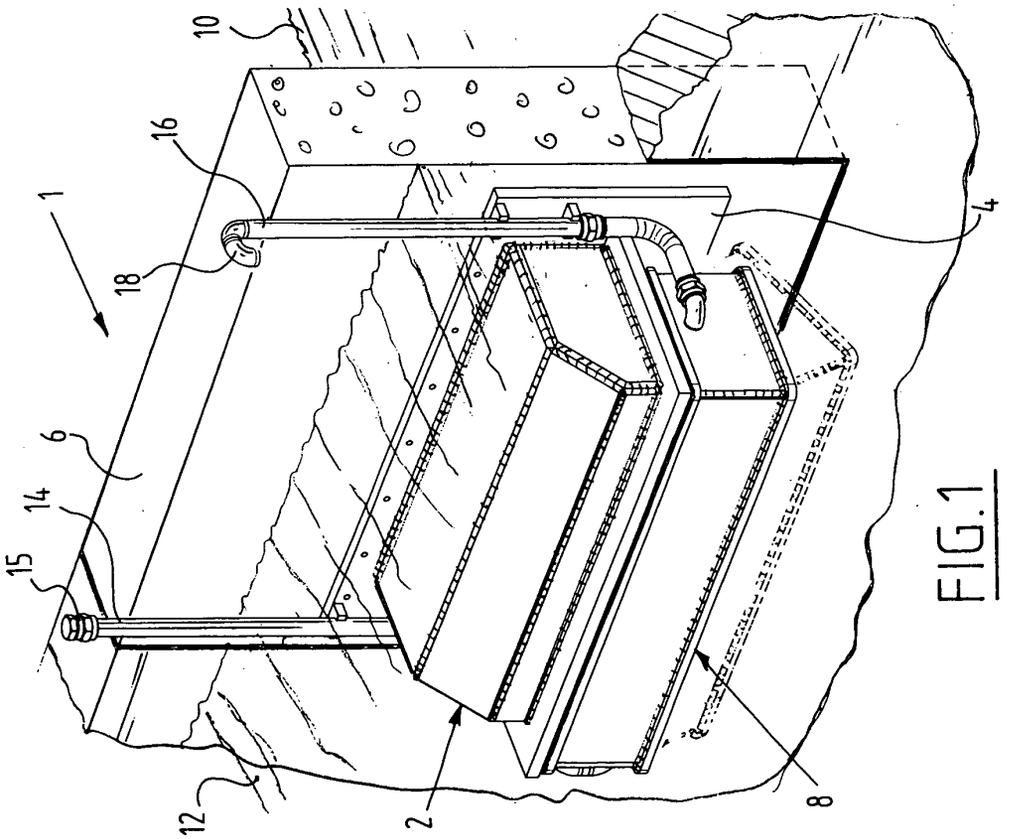

FIG.1

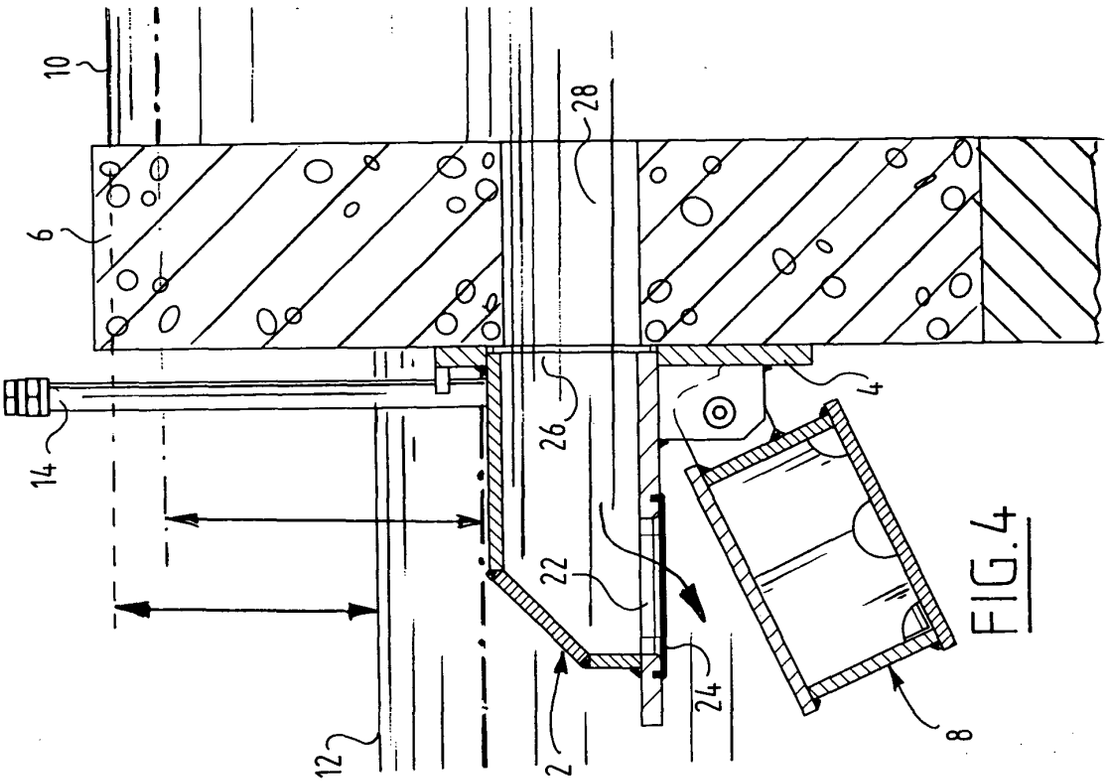

FIG.4

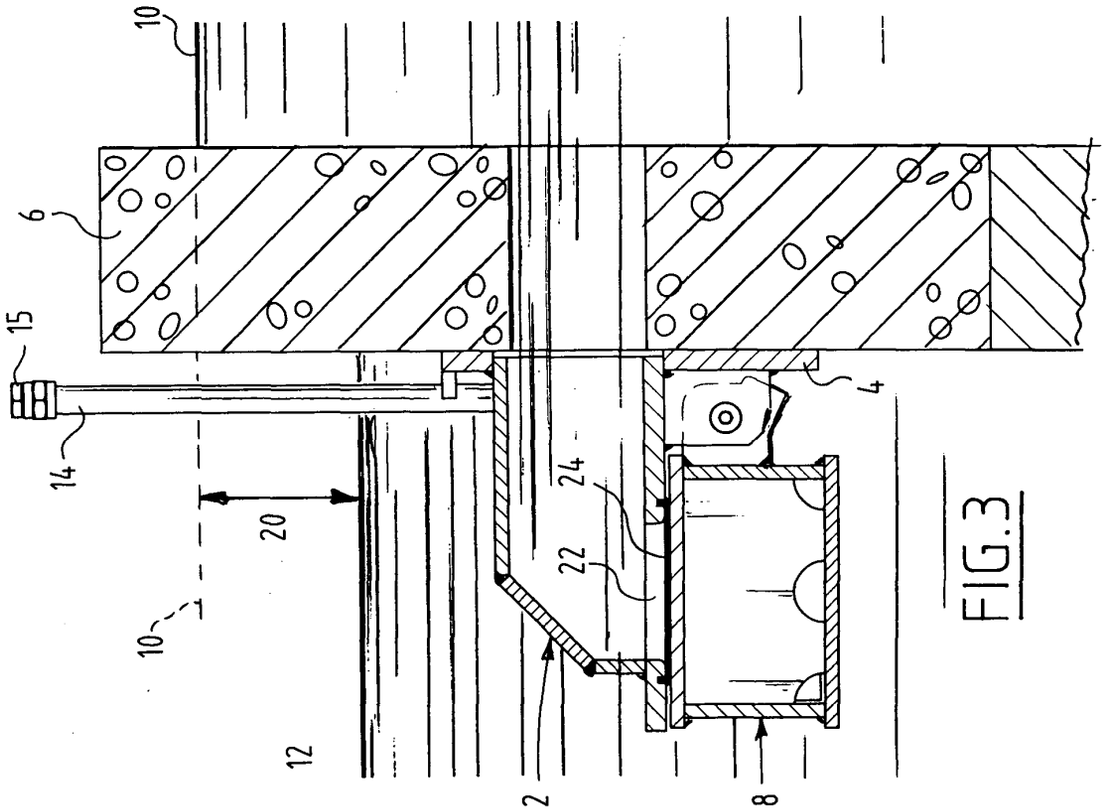

FIG.3

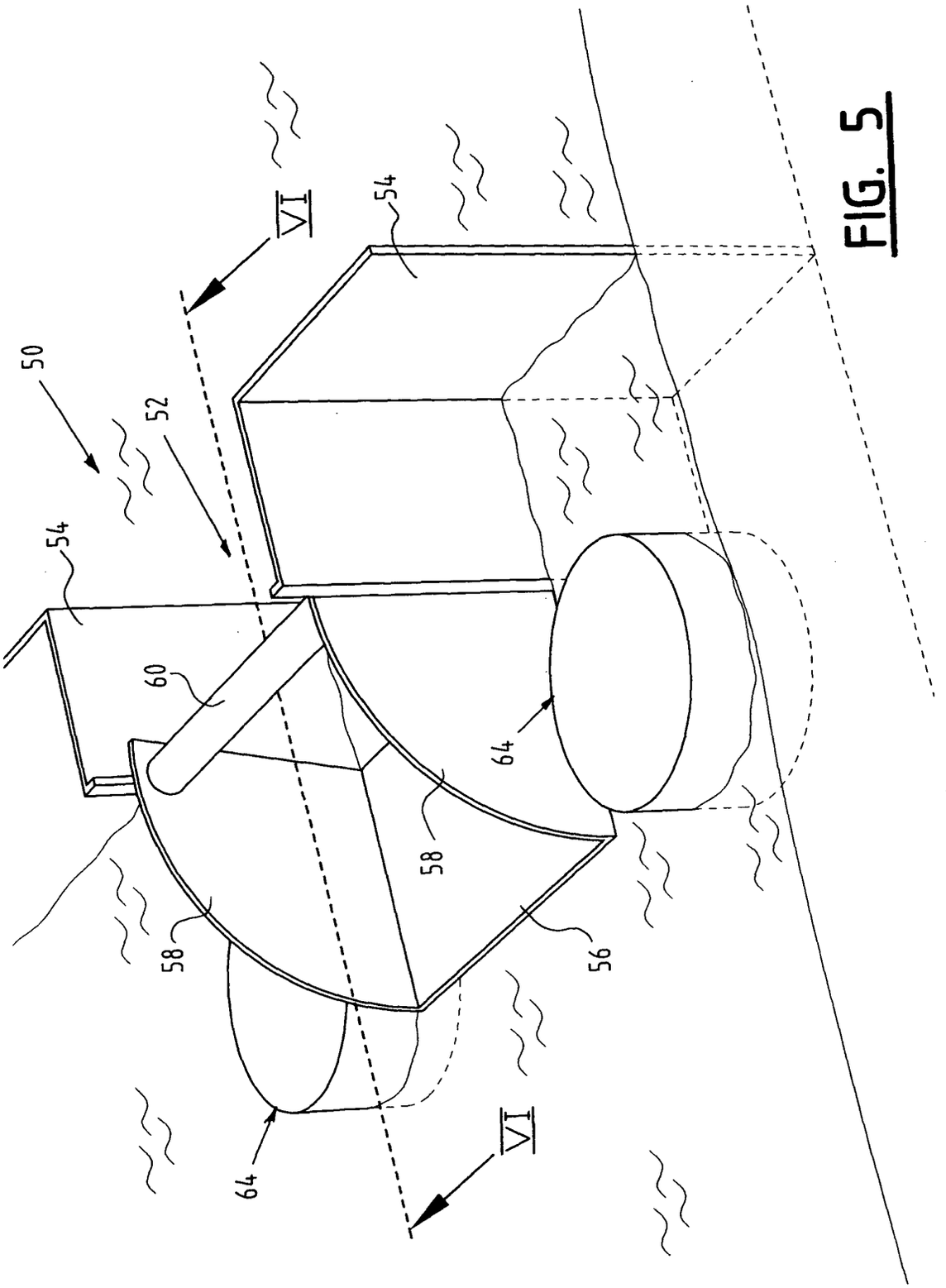

FIG. 5

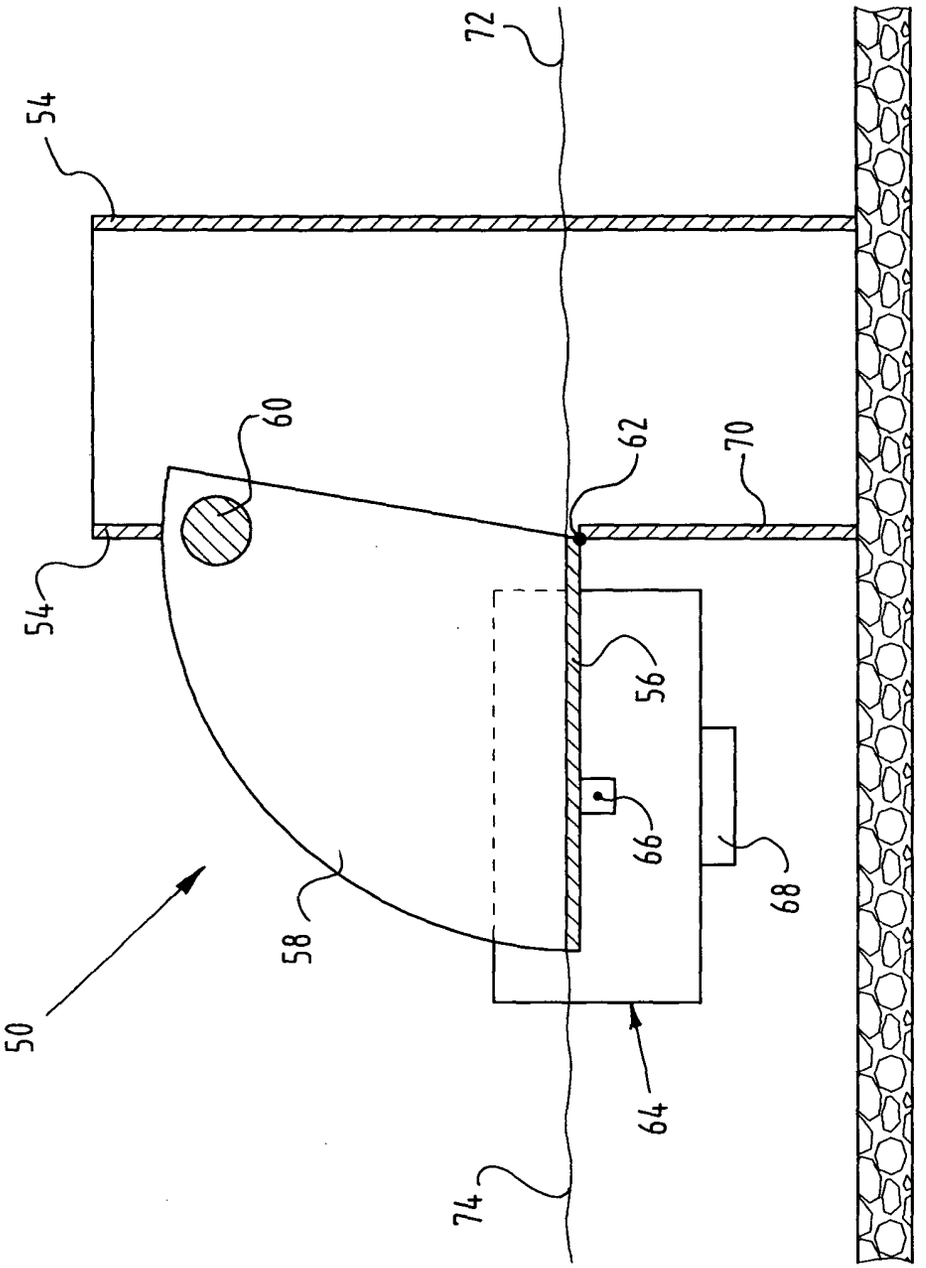

FIG. 6A

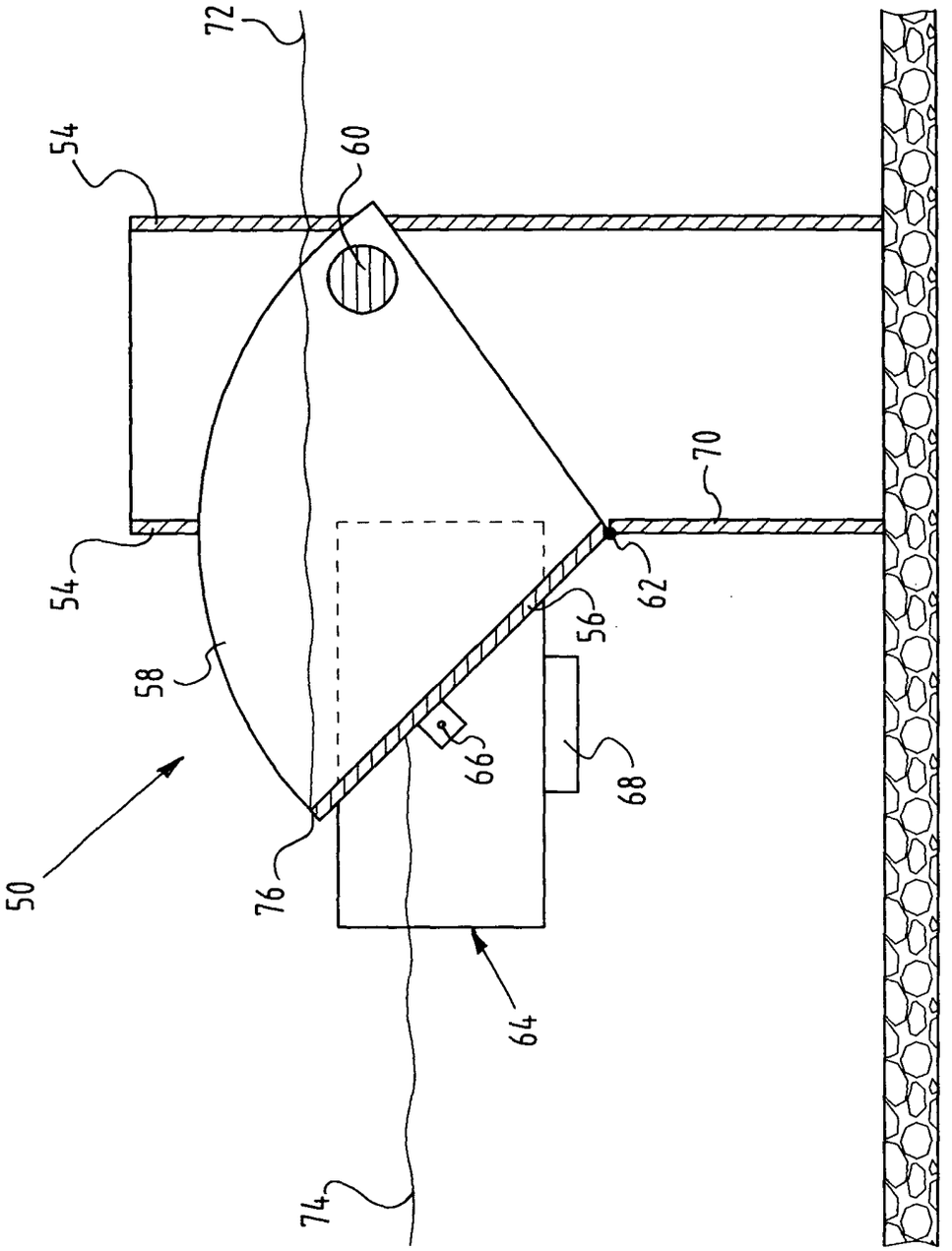

FIG. 6B

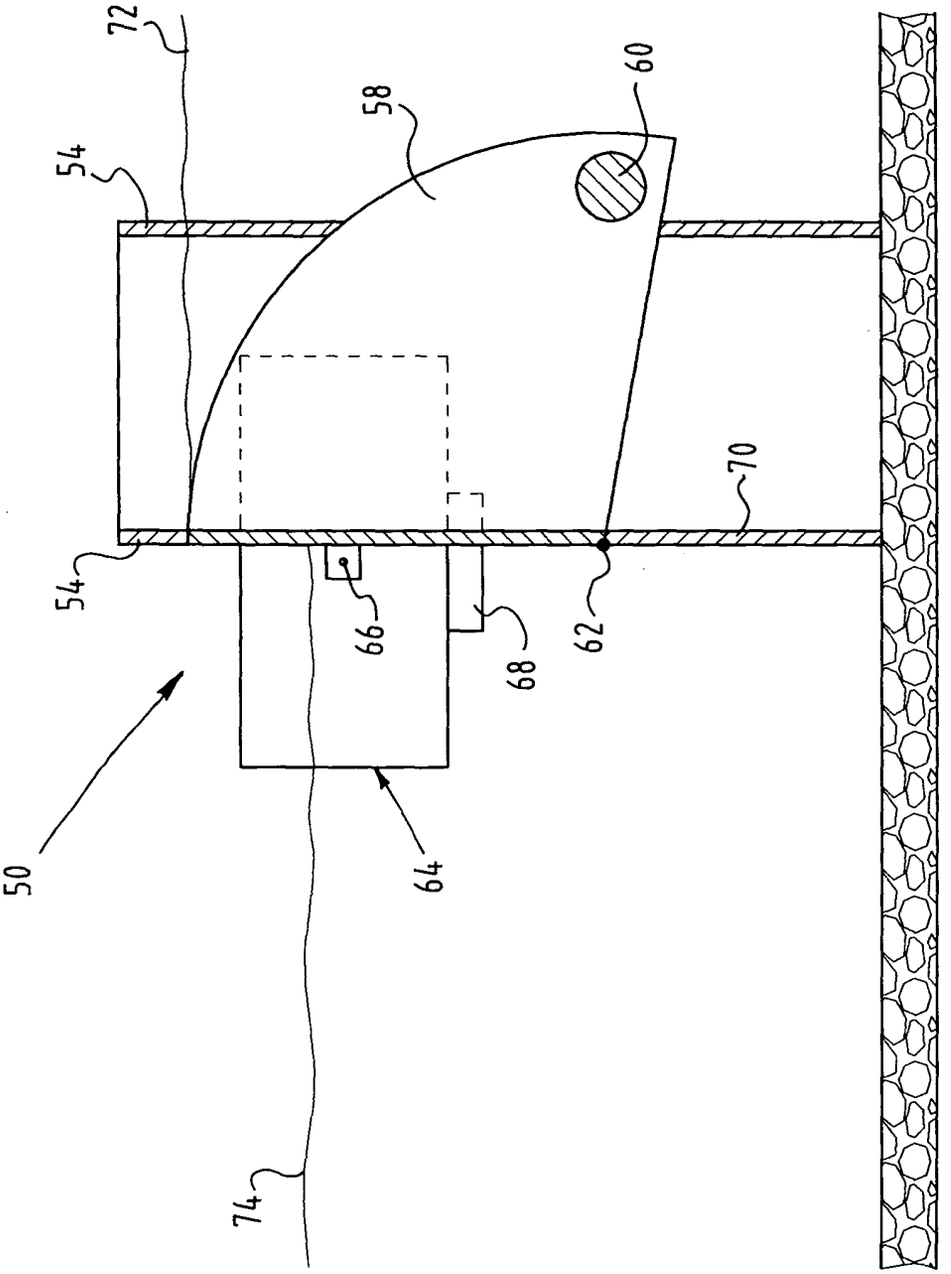

FIG. 6C

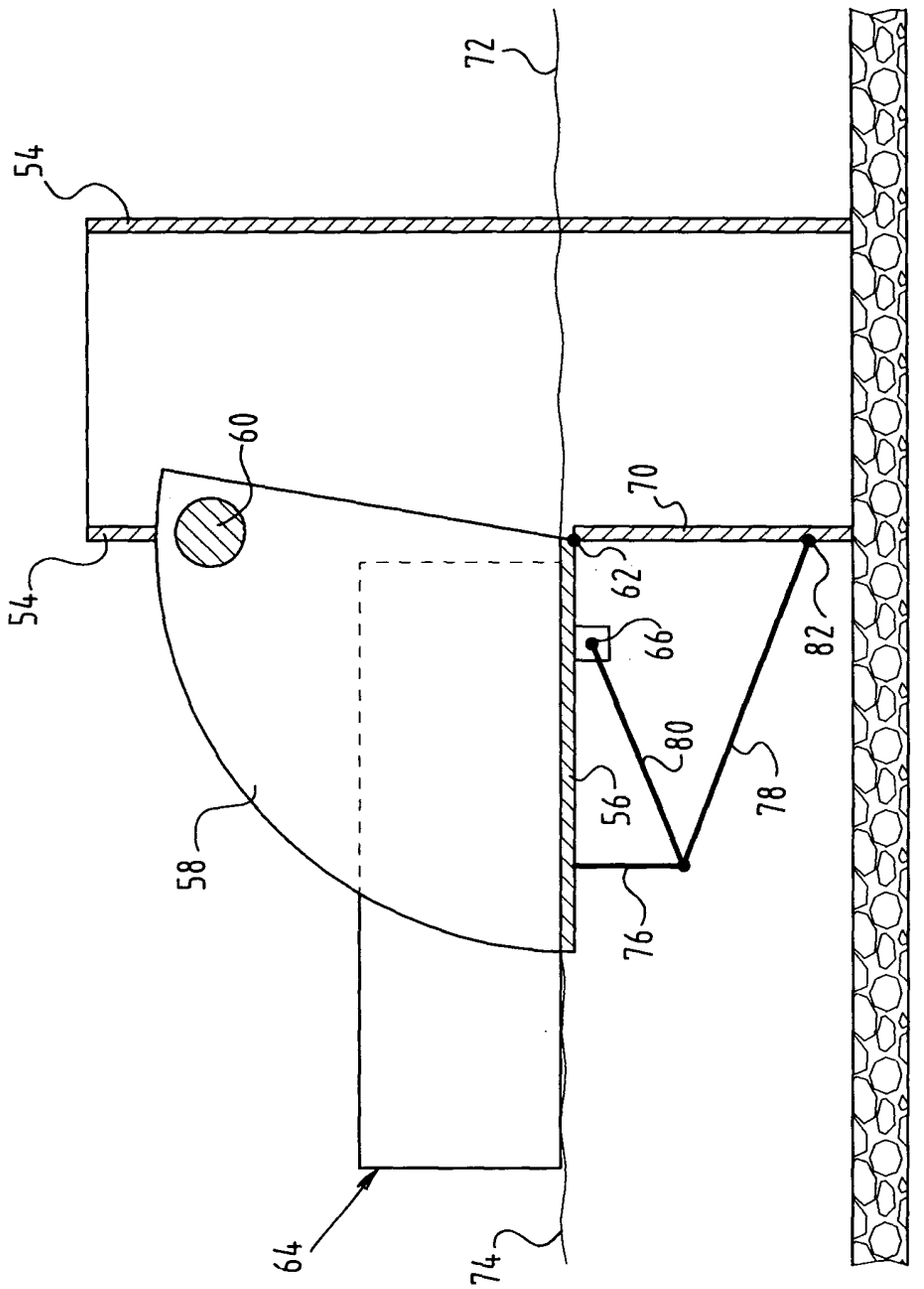

FIG. 7A

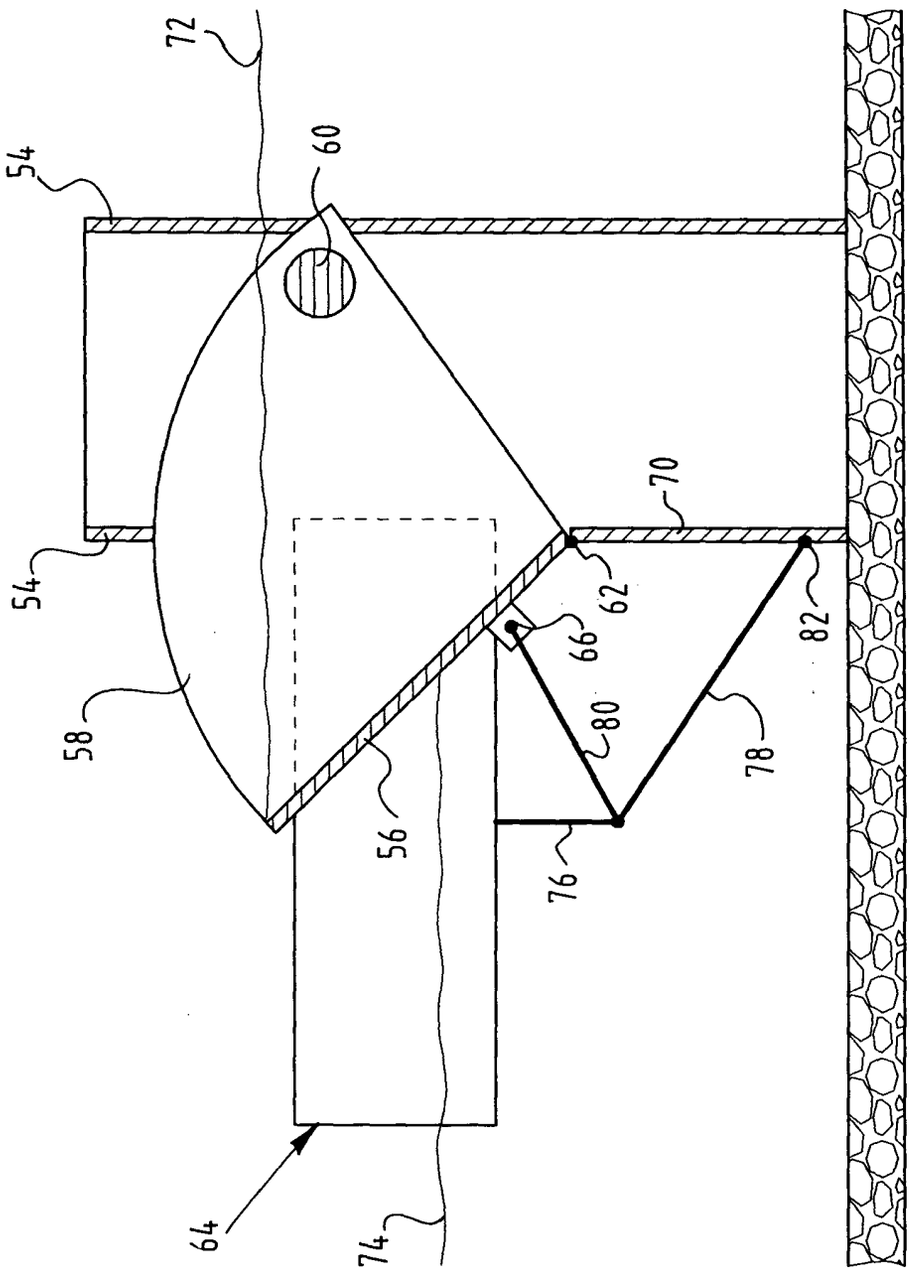

FIG. 7B

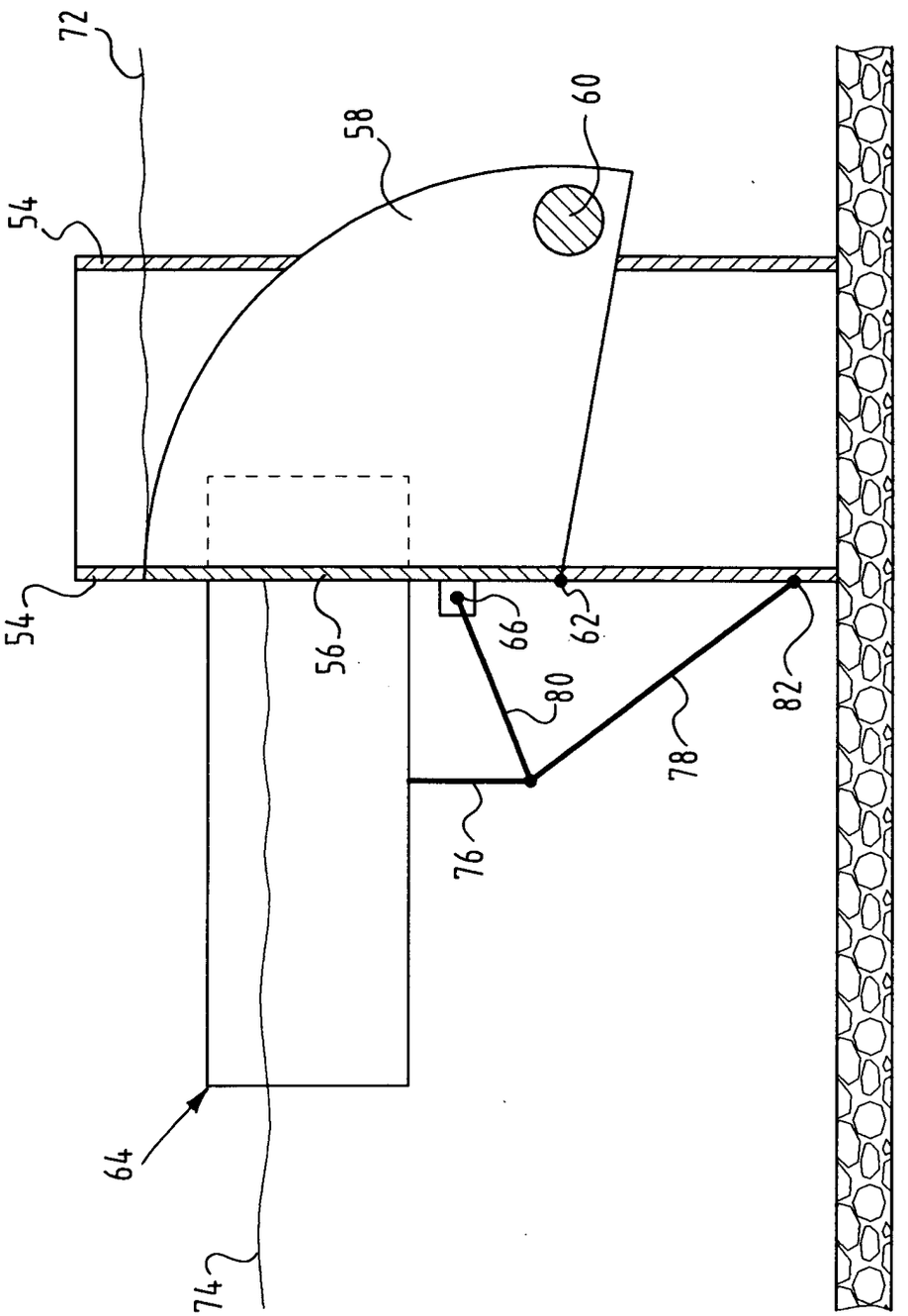

FIG. 7C