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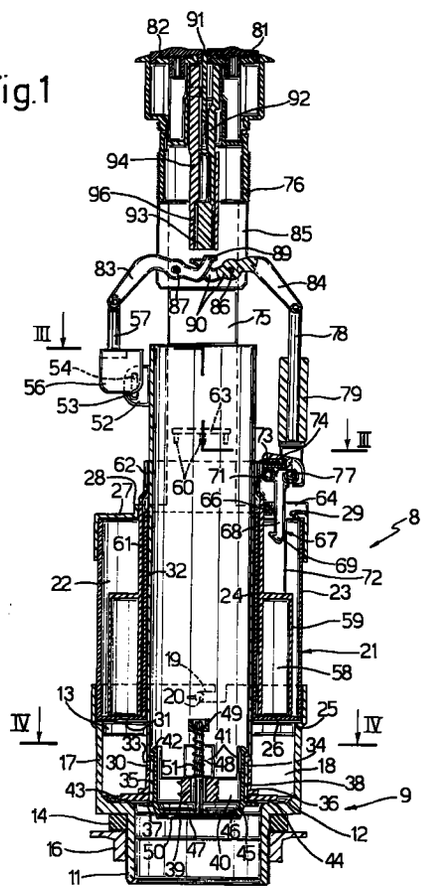
(54) Device for controlling the discharge valve of a lavatory flush tank

(57) The device includes a closing element (43) for closing the valve (43, 44), and which is associated with a first float (32, 47) which is raised to open the valve (43, 44); and a second float (58) concentric with the first float (32, 47), and which is raised to fully discharge the tank (5). The first float (32, 47) is defined by the overflow discharge tube (32), the bottom end (34) of which is normally closed by a disk (47) by virtue of the action of a spring (51). The second float (58) is normally locked upwards by a hook element (67) engaging a fixed stop (66), so as not to affect the downward return movement of the first float (32, 47), and so partially discharge the tank (5). Conversely, when the hook element (67) is released, the second float (58) draws the discharge tube (32) upwards, and delays closing of the discharge tube to fully discharge the tank (5).

Fig.1



EP 0 801 179 A2

Description

The present invention relates to a device for controlling the discharge valve of a lavatory flush tank, and in particular to a water-saving discharge valve control device enabling both total and partial discharge of the water in the tank.

Discharge valve control devices are normally required to so close the valve as to discharge a given amount of water, usually all the water in the tank, and provide for delaying closure of the valve in various ways by exploiting the suction of the outgoing water.

EP-A-10 945 relates to a control device wherein the overflow discharge tube comprises an annular element for closing the discharge valve, so that the overflow discharges via the tube and the annular element; the discharge tube is fitted with a first annular float; and a second float is provided close to the bottom of the tank, and is fitted to a lever extending radially with respect to the discharge tube, and having means for connection to a control member.

The second float is normally locked, so that the discharge tube closes the discharge valve when the water in the tank falls to a given level corresponding to the position of the first float. When released, the second float prevents the control device from being restored to the closing position, so as to delay closing of the valve until the level of the water falls below the second float, and so discharge all the water in the tank. This device presents the drawback of being fairly bulky, on account of the float, as well as being unreliable on account of the connection between the lever of the second float and the control member.

DE-A-3 121 625 relates to a further control device enabling both total and partial discharge of the water in the tank, and wherein the valve closing element is fitted to a first cylindrical float surrounded by a hollow cylinder, which is fitted at the top with a second annular float normally locked by a hook to discharge all the water in the tank. When the hook is released and the first float raised, the hollow cylinder closes the drain when the level of the water lowers the second float, thus preventing the water from being discharged.

This device presents several drawbacks, by requiring a separate overflow discharge tube, separate means for guiding the hollow cylinder, and a complex mechanism for controlling the first float and the hook locking the hollow cylinder.

It is an object of the present invention to provide a device for controlling the discharge valve of a lavatory flush tank, which is extremely compact, straightforward in design, totally reliable, and eliminates the aforementioned drawbacks typically associated with known devices.

According to the present invention, there is provided a device for controlling the discharge valve of a lavatory flush tank, and comprising a closing element for closing said valve, and which is associated with a first float and is raised to open said valve; and a second float for totally discharging said tank; characterized in that said second float is concentric with said first float, and exerts a hydrostatic thrust greater than the weight of said first float; said second float normally being locked upwards, so as not to affect the downward return movement of said first float, and so partially discharge said tank, and being released to delay the return movement of said first float into the idle position, and so totally discharge said tank.

According to a further characteristic of the invention, the discharge valve of the device comprises a closing element fitted to an overflow discharge tube, and which is raised to open said valve; and said discharge tube comprises a plugging element for plugging the bottom end of said discharge tube to enable the discharge tube to also function as a float.

A preferred, non-limiting embodiment of the invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a half section of a device for controlling discharge of a water tank in accordance with the present invention, and shown in the empty-tank position;

Figure 2 shows an outside view of part of the Figure 1 device;

Figure 3 shows a section along line III-III in Figure 1;

Figure 4 shows a section along line IV-IV in Figure 1;

Figure 5 shows the Figure 1 half section in a first operating position;

Figure 6 shows part of the Figure 5 half section in a second operating position.

Number 5 in Figure 5 indicates a lavatory flush tank comprising a standard cock (not shown) for connection to the water supply pipe; a standard float (not shown) for controlling the cock; and a bottom wall 6 with a hole 7 in which is fitted a device for controlling discharge of the water and indicated as a whole by 8. The components of device 8 are normally made of rigid plastic material, so that, hereinafter, the component material is only specified when other than rigid plastic.

Device 8 (Figure 1) comprises a discharge fitting 9 having an externally-threaded bottom portion 11, a flat shoulder 12, and a top portion 13 larger in diameter than bottom portion 11. Portion 11 is inserted inside hole 7 via the interposition of a seal 14, and is fitted to the bottom of tank 5 by a threaded ring nut 16. Portion 13 is connected to shoulder 12 by four axial segments 17 (Figure 4) defining four openings 18 enabling water to flow from tank 5 into portion 11.

Portion 13 comprises an L-shaped slot 19 (Figure 2), which is engaged bayonet-fashion by a radial pin 20 on an annular support indicated as a whole by 21 (Figure 1) and which rests on an annular shoulder 25 of portion 13. By means of a cylindrical outer wall 23, a cylindrical inner wall 24 and a bottom wall 26, support

21 defines an annular chamber 22 closed at the top by a removable cover 27, which is defined inwards by an annular lip 28 larger in diameter than inner wall 24. Cover 27 comprises an opening 29 through which water flows into chamber 22; and bottom wall 26 comprises a calibrated hole 31 by which chamber 22 is emptied slowly.

A normal overflow discharge tube 32 slides inside wall 24, and comprises a bottom shoulder 33 defining the bottom end 34 of tube 32. End 34 comprises a number of axial ribs 30 on which rests a ring nut 35 inserted inside end 34; and ring nut 35 comprises a bottom flange 36 facing a similar flange 37 of a rigid ring 38 having a diametrical dividing wall 40 (Figure 4) with a central hole 39.

Ring 38 comprises four elastic tabs 41, each with a tooth 42, which clicks on to shoulder 33 to grip between flanges 36 and 37 an element for closing the discharge valve; which element comprises a ring 43 of elastic material, which rests against a projection 44 located on the upper surface of shoulder 12 of fitting 9, and defining the seat for the discharge valve of tank 5.

Beneath flange 37, ring 38 comprises a conical lip 45 defined by an annular rib 46, and forming a seat for a plugging element comprising a disk 47, which plugs seat 45, and hence the bottom end 34 of tube 32, so that tube 32 acts as a first float for controlling the return movement of ring 43 into the position closing the discharge valve.

Disk 47 is integral with a central rod 48 guided by hole 39 in dividing wall 40, and fitted removably at the top end with a supporting element 49 for a helical compression spring 51, the other end of which rests against the upper surface of dividing wall 40. Disk 47 also comprises a calibrated hole 50 allowing the passage of a certain amount of water, and spring 51 is so sized that disk 47 is detached from seat 45 when the column of water inside tube 32 exceeds by a given amount the maximum level H (Figure 5) of tank 5.

At the top, discharge tube 32 comprises an outer radial tab 52 with a vertical slot 53, which is engaged by a pin 54 fitted to a plate 56; and plate 56 comprises a bent tab fitted to a tie 57, which is raised to lift tube 32 and open the discharge valve.

Chamber 22 houses a second float comprising an annular chamber 58 enclosed in an open-bottom casing 59, and which may house a ring made of material of a low specific weight. The inner wall of casing 59 projects upwards into a sleeve 61, which is guided between wall 24 of support 21 and inner lip 28 of cover 27, so that second float 58 is located a minimum radial distance from tube 32. When immersed in the water, the hydrostatic thrust of float 58 is greater than the weight of tube 32.

Sleeve 61 comprises a slightly smaller-diameter top portion 62, which slides on the outer surface of tube 32; and tube 32 comprises two radial appendixes 63, each with a number of ribs 60, which are engaged by the top edge of portion 62 of sleeve 61. At opening 29, cover 27 comprises a pair of radial tabs 64 connected by a trapezoidal-section bar 66, which forms a fixed stop element for a hook element 67 fitted to sleeve 61.

More specifically, hook element 67 comprises a lever 68 having a hook-shaped bottom end 69 for engaging bar 66. Lever 68 pivots on a pin 71 fitted to a pair of radial ribs 72 integral with sleeve 61, is pushed clockwise by a compression spring 73 housed in a seat 74 on lever 68 and resting against a depression on portion 62, and is connected in articulated manner by a pin 77 to a control tie 78, which is raised to release hook-shaped end 69 from bar 66 and raise sleeve 61 together with float 58. Tie 78 may be provided with a weight 79 to assist, or even replace, spring 73.

Cover 27 is connected by two vertical bars 75 (Figures 3 and 5) to an upper fitting 76 connected in any known manner to a hole 88 formed in the usual cover 80 of tank 5 and coaxial with hole 7 in bottom wall 6. Fitting 76 comprises a pair of parallel wings 85 extending downwards and fitted with two parallel pins 86 and 87 on which pivot two transmission levers 83 and 84 connected in articulated manner to ties 57 and 78. Ties 57 and 78 are located in a substantially radial plane with respect to tube 32, so that levers 83 and 84 are movable in said radial plane, and each present a control arm 89, 90 extending towards the axis of fitting 76.

Two substantially semicircular push-buttons 81 and 82 are housed side by side in sliding manner inside fitting 76, and are separated by a diametrical dividing wall 91. Push-button 81 is fitted to a respective push rod 92 terminating at the bottom with a central cylindrical element 93, which acts on arm 89 of tie 83; and push-button 82 is fitted to a further push rod 94 terminating at the bottom with a hollow element 96 coaxial with element 93, and which acts on arm 90 of tie 84; for which purpose, arm 90 is in the form of a fork, the branches of which are located on either side of arm 89.

The control device operates as follows.

When idle, tank 5 (Figure 5) is filled with water up to level H defined by the usual float closing the supply cock; overflow discharge tube 32 is in the lowered position shown in Figure 5, wherein ring 43 rests on projection 44 so that the discharge valve is closed; and the water in chamber 22 pushes float 58 upwards, so that the hook-shaped end 69 of lever 68 is arrested against bar 66.

If the supply cock is not fully closed, the water continues rising until it flows over the top edge of tube 32. Part of the water in tube 32 flows through hole 50 and out through portion 11 of fitting 9, while the rest exerts on disk 47 a pressure corresponding to the level of the water in tube 32. When the pressure exceeds the force exerted by spring 51, disk 47 is detached from seat 45, and the water accumulated in tube 32 is discharged rapidly through portion 11 of fitting 9.

When push-button 81 is pressed, cylindrical element 93 of push rod 92 acts on arm 89 to rotate lever 83 clockwise; and, by means of tie 57, plate 56 and the pin 54/slot 53 connection, lever 83 raises tube 32 to detach

ring 43 from projection 44 and open the discharge valve.

At this point, the water starts flowing out through portion 11 of fitting 9, thus creating a hydrostatic thrust on the float comprising disk 47 and tube 32, so that tube 32 remains in the raised position. Hole 50 allows water to flow into tube 32, thus reducing the upward thrust of float 47, 32; and, after a certain time, when the water eventually falls to an intermediate level h at which the hydrostatic thrust on float 47, 32 equals the weight of the float, the float becomes ineffective and tube 32 moves down by force of gravity to close the discharge valve.

Conversely, when push-button 82 is pressed, hollow element 96 of push rod 94 acts on arm 90 to rotate lever 84 anticlockwise. By means of tie 78 and pin 77, lever 84 first rotates hook element 67 to free it from bar 66 in opposition to spring 73; and float 58 is pushed hydrostatically upwards so that the top edge of portion 62 of sleeve 61 engages ribs 60 of appendixes 63 of tube 32.

Still pressing push-button 82, tie 78 draws sleeve 61, and with it tube 32, positively upwards to open the discharge valve as shown in Figure 6, so that tube 32 begins to float, while float 58 is pushed hydrostatically against cover 27 to help raise tube 32. At this point, the water flows towards the drain, but when the hydrostatic thrust on tube 32 equals its weight, tube 32 is prevented from moving down by force of gravity by still being maintained in the raised position by float 58.

As calibrated hole 31 provides for slowly emptying chamber 22, the hydrostatic thrust on float 58 is maintained by the water in chamber 22, even when the water level in tank 5 falls below bottom wall 26; and sleeve 61 keeps tube 32 in the raised position to empty tank 5 completely, down to level L of openings 18. Finally, as chamber 22 empties, float 58 moves down together with tube 32 so that ring 43 is brought to rest once more on projection 44, thus closing the discharge valve.

As push-button 82 (Figure 5) is normally released before float 58 starts to move down, by the time this occurs, spring 73 and/or weight 79 have already moved hook element 67 back into the idle position; the hook-shaped end 69 engages the inclined upper surface of bar 66, and is rotated over the bar to enable float 58 to move into the lowered position contacting wall 26.

As compared with known devices, the advantages of the control device according to the invention will be clear from the foregoing description. In particular, using the overflow discharge tube 32 as a first float, and a second float 58 concentric with and at a minimum distance from tube 32, provides for greatly reducing the size of the control device fitted inside tank 5. Moreover, when fully discharging the tank, the hydrostatic thrust of the second float 58 reduces the pressure required to operate push-button 82. And finally, slowly emptying chamber 22 housing the second float 58 ensures tank 5 is emptied completely.

Clearly, changes may be made to the control device as described and illustrated herein without, however, departing from the scope of the present invention. For example, the float (32, 47) controlling the valve may be separate from overflow discharge tube 32; and, as opposed to being threaded, portion 11 of fitting 9 and ring nut 16 may be smooth, click-on types.

Also, discharge tube 32 may comprise axial ribs to reduce sliding friction; disk 47 need not necessarily comprise hole 50; and some of the components of the control device may be made of metal alloy as opposed to plastic material, and be connected otherwise than as described.

Claims

1. A device for controlling the discharge valve of a lavatory flush tank, and comprising a closing element (43) for closing said valve (43, 44), and which is associated with a first float (32, 47) and is raised to open said valve (43, 44); and a second float (58) for totally discharging said tank (5); characterized in that said second float (58) is concentric with said first float (32, 47), and exerts a hydrostatic thrust greater than the weight of said first float (32, 47); said second float (58) normally being locked upwards, so as not to affect the downward return movement of said first float (32, 47), and so partially discharge said tank (5), and being released to delay the return movement of said first float (32, 47) into the idle position, and so totally discharge said tank (5).

2. A device as claimed in Claim 1, characterized in that said first float (32, 47) comprises a discharge tube (32), the bottom end of which is normally closed by a plugging element (47) which is released by a predetermined column of water in said discharge tube (32).

3. A device as claimed in Claim 1 or 2, characterized in that said second float (58) is movable axially inside an annular chamber (22) having an inner wall (24) guiding said discharge tube (32).

4. A device as claimed in Claim 3, characterized in that said chamber (22) comprises a bottom wall (26) having a calibrated hole (31) for delaying the discharge of water from said chamber (22) and so delaying the downward return movement of said second float (58).

5. A device as claimed in Claim 3 or 4, characterized in that said second float (58) comprises a sleeve (61) extending upwards beyond said chamber (22); said sleeve (61) supporting a hook element (67), which is normally arrested against a fixed element (66) to arrest the upward movement of said second float (58).

6. A device as claimed in Claim 5, characterized in

that said hook element (67) pivots on a rib (72) of said sleeve (61); said hook element (67) being rotated to release said fixed element (66).

7. A device as claimed in Claim 6, characterized in that said hook element (67) is maintained in the engaged position by flexible means (73, 79) comprising a spring (73) and/or a counterweight (79).

8. A device as claimed in Claim 7, characterized in that said discharge tube (32) is raised by a first tie (57) to effect said partial discharge; said hook element (67) being connected in articulated manner (77) to a second tie (78) for rotating said hook element (67) in opposition to said flexible means (73, 79).

9. A device as claimed in Claim 8, characterized in that said discharge tube (32) comprises at least one radial element (60) which is engaged by an element (62) of said sleeve (61).

10. A device as claimed in Claim 9, characterized in that said second tie (78), when activated, and after rotating said hook element (67), draws said sleeve (61) upwards to positively raise said discharge tube (32).

11. A device as claimed in one of the foregoing Claims from 8 to 10, characterized in that each of said ties (57, 78) is activated by a corresponding push-button (81, 82) via a transmission lever (83, 84) movable in a radial plane with respect to said discharge tube (32).

12. A device as claimed in Claim 11, characterized in that said transmission levers (83, 84) pivot on two parallel pins (86, 87) fitted to a common cylindrical support (76) coaxial with said discharge tube (32); each of said transmission levers (83, 84) comprising an operating arm (89, 90) extending towards the axis of said cylindrical support (76).

13. A device as claimed in Claim 12, characterized in that said push-buttons (81, 82) are substantially semicircular, are housed in said cylindrical support (76), and are separated by a diametrical dividing wall (91) of said cylindrical support (76).

14. A device as claimed in Claim 13, characterized in that one of said push-buttons (81, 82) acts on the operating arm (89) of one of said transmission levers (83, 84) via a central element (93) movable axially in said cylindrical support (76); the operating arm (90) of the other of said transmission levers (83, 84) being fork-shaped, and being operated by the other of said push-buttons (81, 82) via a hollow element (94) coaxial with said central element (93).

15. A device for controlling the discharge valve of a lavatory flush tank, wherein the discharge valve (43, 44) comprises a closing element (43) fitted to an overflow discharge tube (32), and which is raised to open said valve (43, 44); characterized in that said discharge tube (32) comprises a plugging element (47) for plugging the bottom end (34) of said discharge tube (32) to enable the discharge tube (32) to also function as a float.

16. A device as claimed in Claim 2 or 15, characterized in that said plugging element comprises a disk (47) held in the plugging position by spring means (51), which are so sized that said disk (47) is detached from a seat (45) at said bottom end (34) when the column of water inside said discharge tube (32) exceeds a predetermined level.

17. A device as claimed in Claim 16, characterized in that said disk (47) comprises a calibrated hole (50) enabling the discharge of small amounts of water to accelerate the return movement of said discharge tube (32) to the idle position.

18. A device as claimed in Claim 17, characterized in that said disk (47) is integral with a central rod (48), and is maintained, by said spring means (51), resting against a seat (45) on a rigid ring (38); snap-on means (41) being provided to connect said rigid ring (38) to an inner shoulder (33) of said discharge tube (32).

19. A device as claimed in Claim 18, characterized in that said spring means comprise a helical compression spring (51) located between a pair of stop elements (40, 49) supported respectively on said rigid ring (38) and said rod (48).

20. A device as claimed in Claim 18 or 19, characterized in that said closing element comprises a ring (43) of elastic material, which is gripped between a flange (37) of said rigid ring (38) and a flange (36) of a further lock ring (35) at said bottom end (34).

21. A device as claimed in one of the foregoing Claims from 15 to 20, characterized in that said discharge tube (32) is raised by a control member (57) connected to said discharge tube (32) by means (53, 54) enabling said control member (57) and said discharge tube (32) to return independently to the idle position.

Fig.1

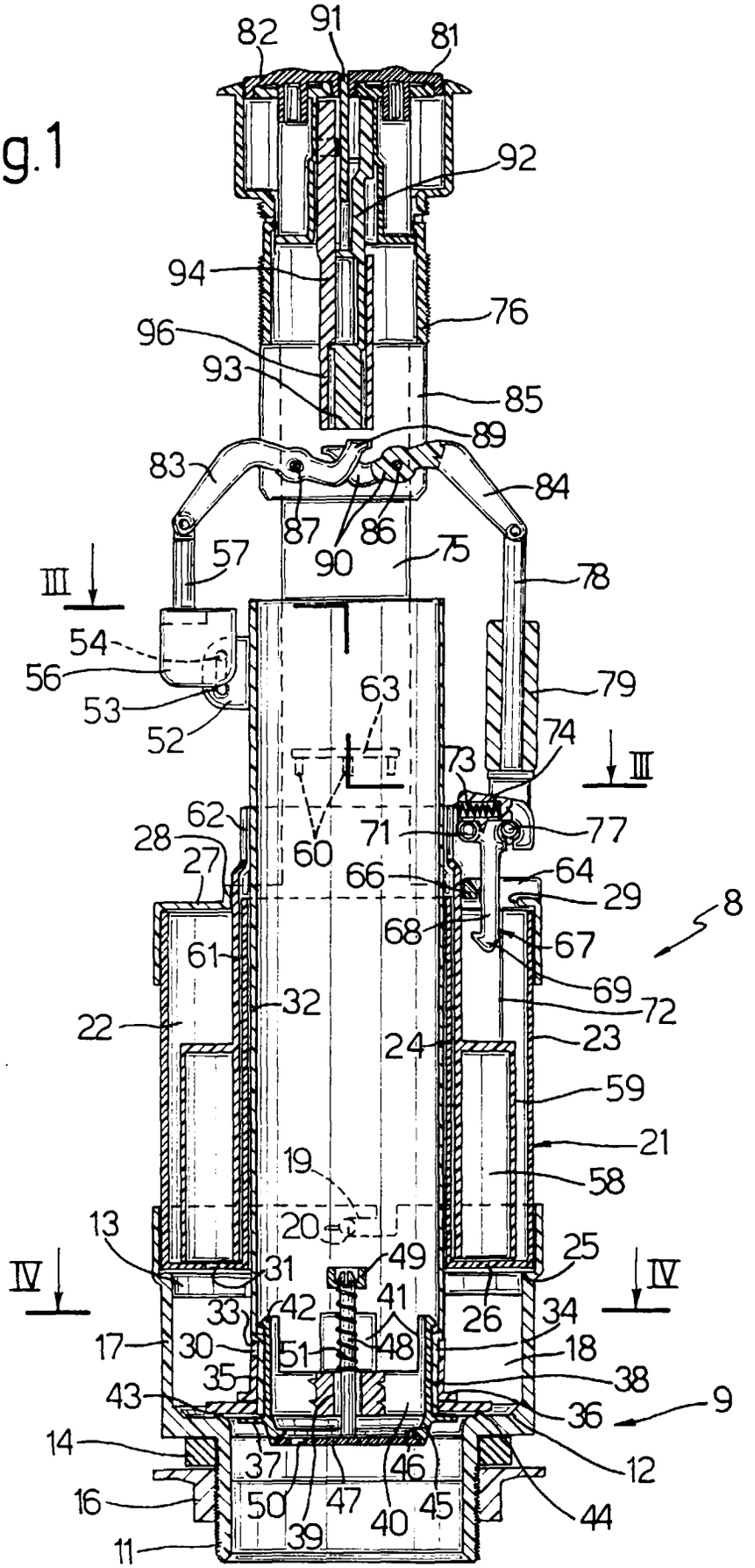

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Fig.3

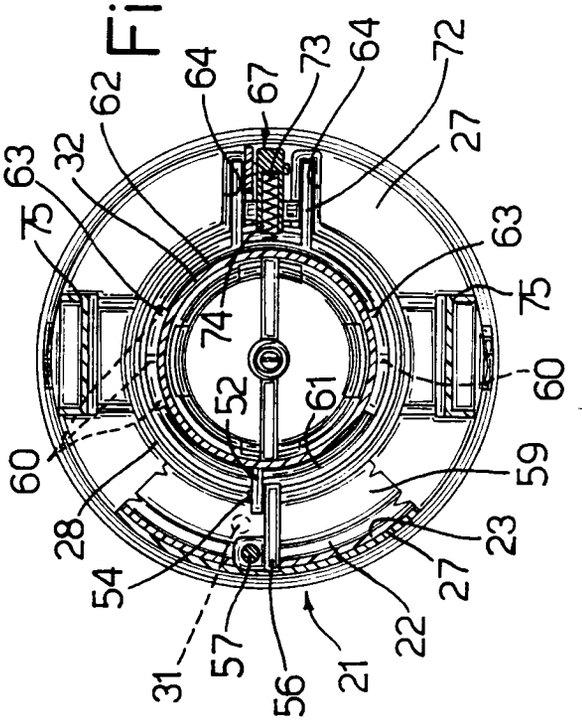


Fig.4

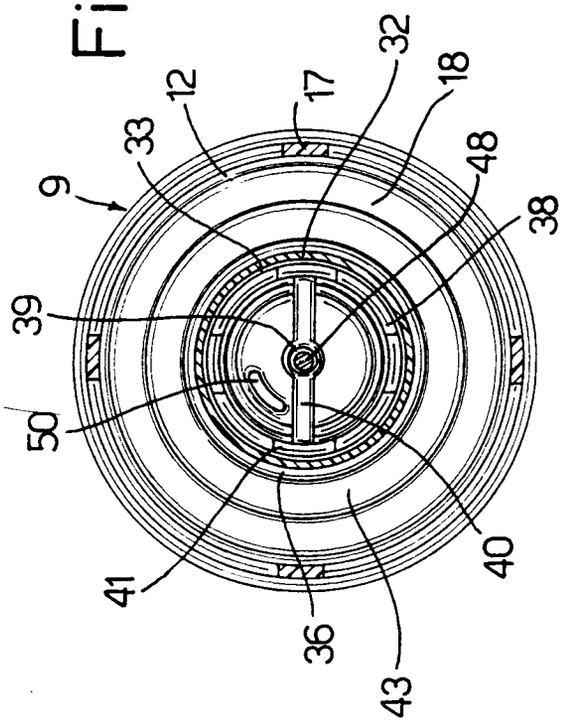


Fig.2

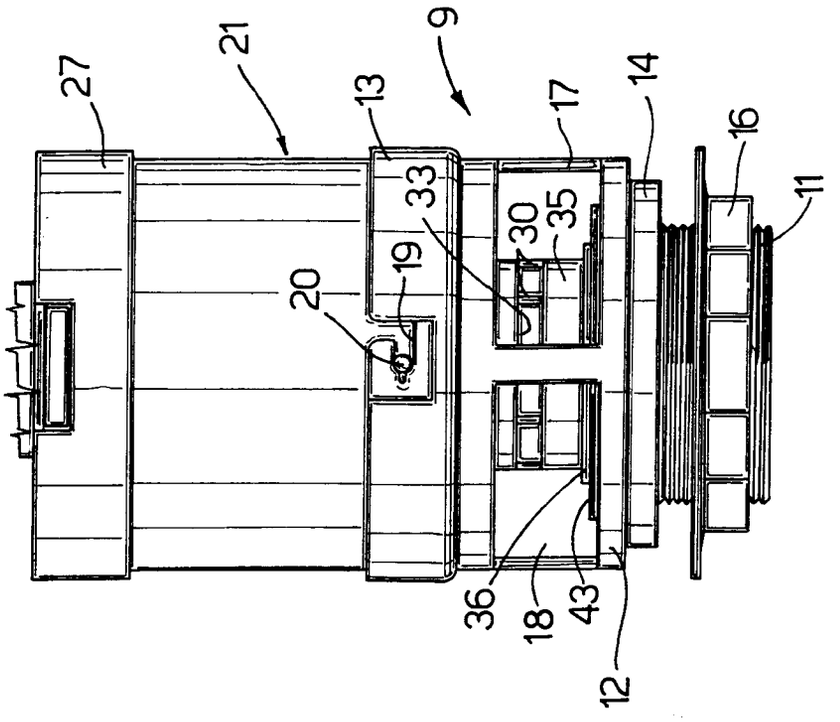
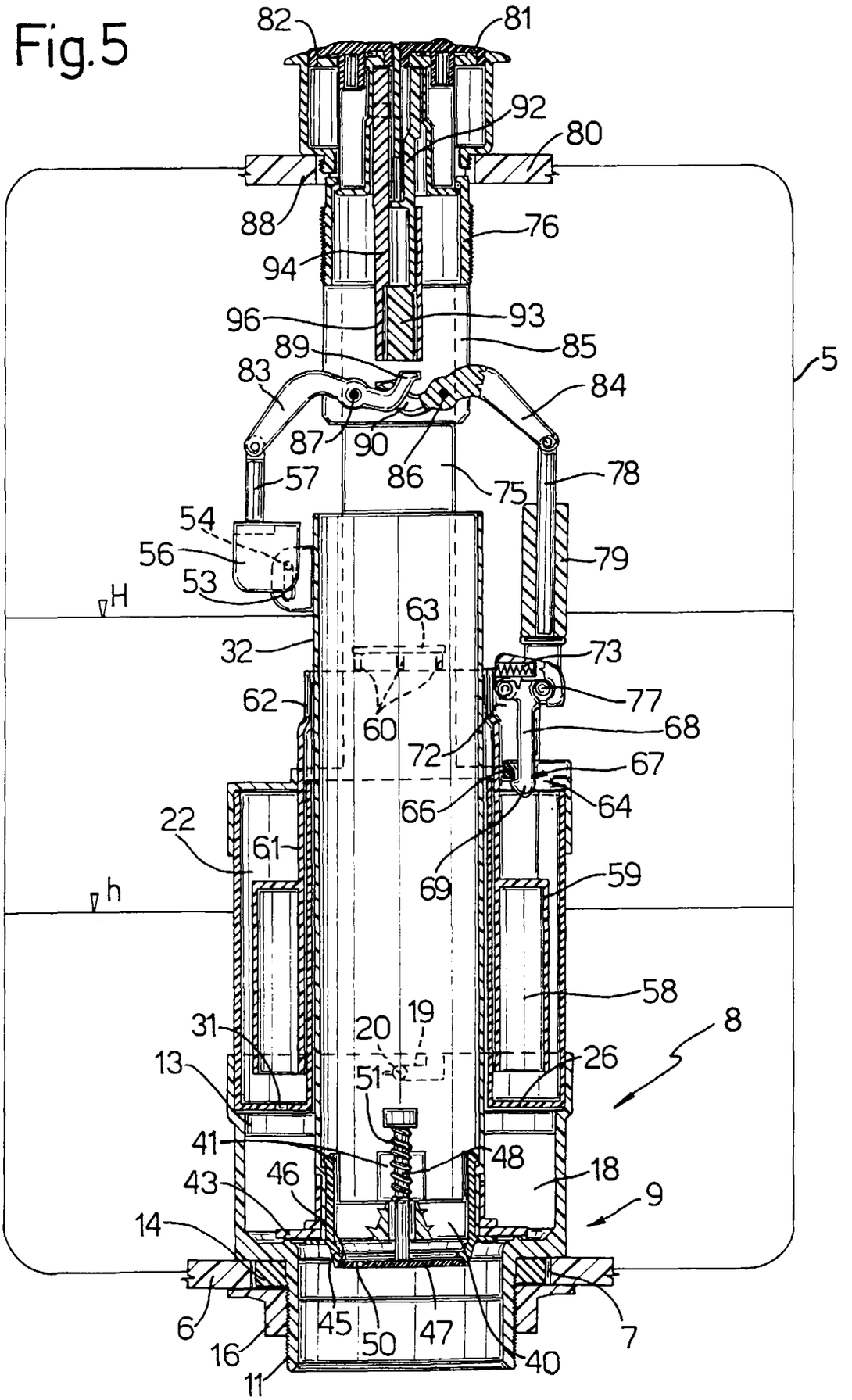


Fig.5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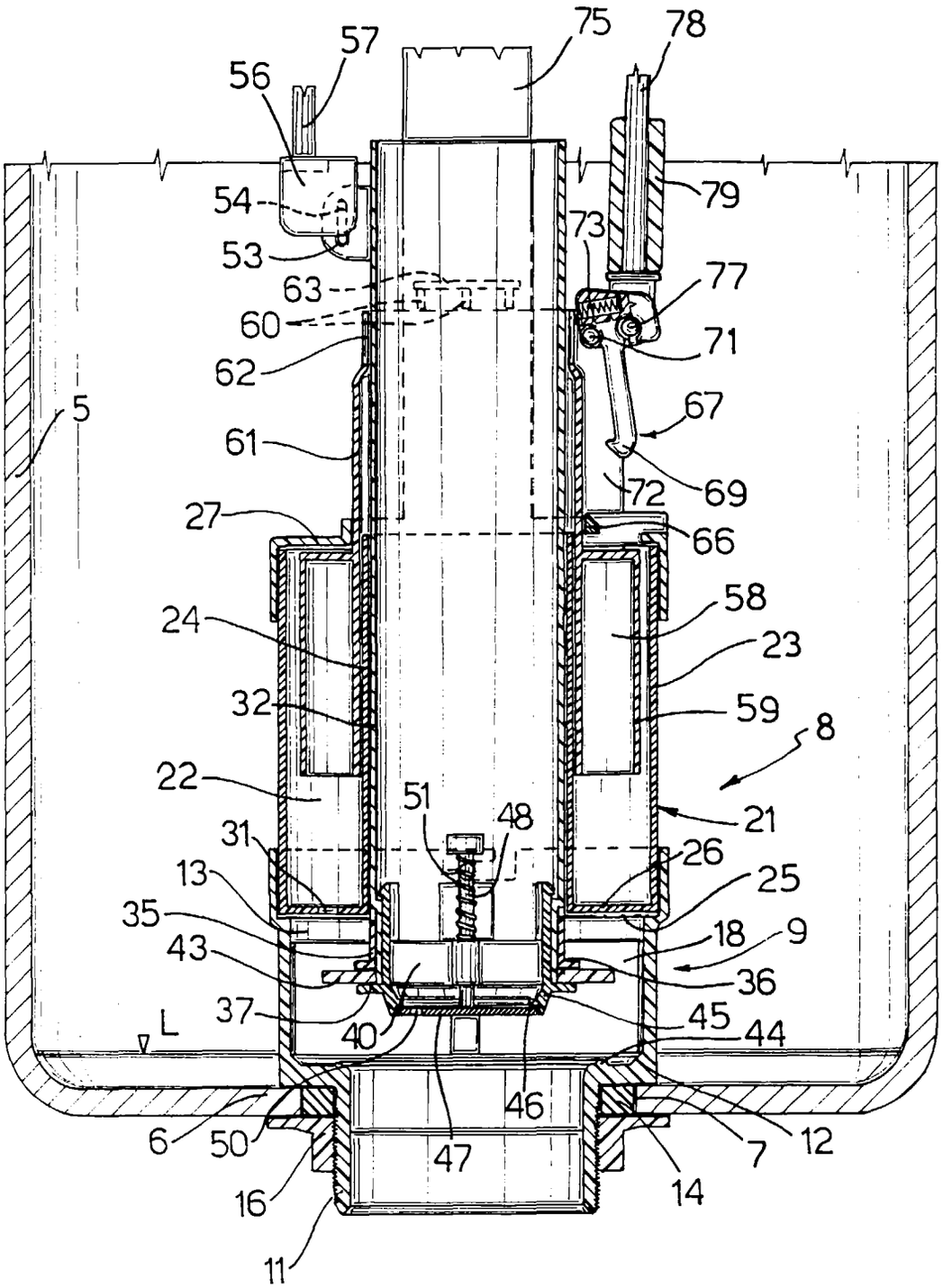
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Fig.6