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(54) **Flush tank flush valve assembly**

(57) A flush tank flush valve assembly (1) has a supporting structure (2) with a vessel (8); a valve body (3) sliding along an axis (A) inside the vessel, and having a shutter (30) cooperating with a fluidtight seat (7); and a float (40) housed in the vessel and cooperating with the valve body; the float (40) is hinged to the vessel (8), and rotates about an axis of rotation, substantially perpendicular to the axis (A), to selectively engage the valve body (3) as the water level in the vessel (8) varies.

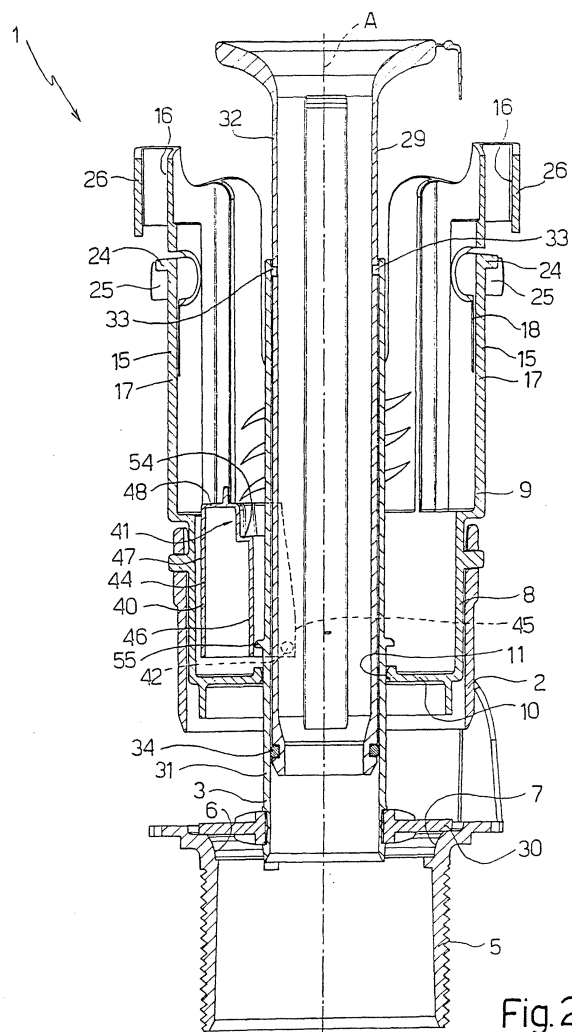


Fig. 2

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Description

[0001] The present invention relates to a flush tank flush valve assembly.

[0002] Flush tank flush valve assemblies are known, which comprise a supporting structure fixed to a bottom wall of the tank and having a drain hole bounded by a fluidtight seat; and a valve body (usually a tubular member which also acts as an overflow pipe) housed in sliding manner inside the supporting structure, and having a shutter at the bottom, which cooperates with the fluidtight seat to close the drain hole. The valve body is raised by user-controlled actuating members to drain the water from the tank, is restored by gravity to the closed position, and its downward movement is slowed down by the buoyancy of the valve body itself and possibly of a float associated with the valve body.

[0003] Known valve assemblies have various drawbacks, particularly in terms of reliability; easy, low-cost production; effective, practical use; and precise adjustment of the amount of water discharged.

[0004] Various types of valve assemblies, with different flush modes, are known, and which include : single-flush valve assemblies (for simply discharging a predetermined amount of water from the tank); stop-function valve assemblies (i.e. single-flush types, but which permit stoppage by the user); and dual-flush valve assemblies (i.e. for discharging all or only part of the water from the tank).

[0005] Systems are also known for constructing different types of valve assemblies from basic common component parts, and by replacing and/or adding specific parts for each type. Known systems of this type, however, are unsatisfactory in various respects, by involving replacement and/or addition of a relatively large number of parts. The complexity of these systems is also partly due to the relatively complex design of the basic version, i.e. the single-flush valve assembly.

[0006] It is an object of the present invention to provide a flush tank flush valve assembly designed to eliminate the aforementioned drawbacks of the known art. More specifically, it is an object of the invention to provide a valve assembly which is both straightforward and highly efficient. It is a further object of the invention to provide a valve assembly which can be adapted quickly and easily to operate in different modes (single-flush, stop-function single-flush, dual-flush).

[0007] According to the present invention, there is provided a flush tank flush valve assembly, as claimed in the accompanying Claim 1.

[0008] The valve assembly according to the invention is extremely cheap and easy to produce, is of extremely simple, safe, reliable operation, and, by simply replacing a small number of component parts, can be adapted to operate in various modes (single-flush, stop-function single-flush, dual-flush).

[0009] A non-limiting embodiment of the present invention will be described by way of example with refer-

ence to the accompanying drawings, in which:

Figure 1 shows a view in perspective of a valve assembly in accordance with the invention;

Figure 2 shows a longitudinal section, with parts removed for clarity, of the Figure 1 valve assembly;

Figure 3 shows a cross section, with parts removed for clarity, of the Figure 1 valve assembly;

Figure 4 shows a side view of a component part of the Figure 1 valve assembly;

Figure 5 shows a view in perspective of a further component part of the Figure 1 valve assembly;

Figure 6 shows, schematically, operation of the Figure 1 valve assembly;

Figure 7 shows a different version of the Figure 1 valve assembly.

[0010] With reference to Figures 1 and 2, number 1 indicates as a whole a valve assembly, in particular a single-flush valve assembly, of a known flush tank (not shown). Valve assembly 1 comprises a supporting structure 2; a valve body 3 extending and sliding along an axis A; and a control assembly 4.

[0011] Structure 2 is fixed to a bottom wall of the tank by a threaded sleeve 5 having a drain hole 6 bounded by a fluidtight seat 7, and comprises an open-topped vessel 8 bounded by a substantially cylindrical lateral wall 9, and having a bottom wall 10 with a central hole 11.

[0012] As shown in Figure 3, two guide members 12, diametrically opposite with respect to central hole 11, extend parallel to axis A from bottom wall 10, and define, together with central hole 11, a slide seat 13 for valve body 3.

[0013] Structure 2 also comprises two flexible, diametrically opposite tabs 15, and two supporting seats 16, the function of which is described below.

[0014] Tabs 15 are defined by respective wall portions 17 of structure 2, and specifically by respective portions 17 of lateral wall 9; and each tab 15 is bounded by a contour 18 cut through lateral wall 9, and is connected to lateral wall 9 solely by a substantially straight connecting edge 19.

[0015] As shown also in Figure 4, each tab 15 is substantially L-shaped, and comprises a root portion 21 extending from connecting edge 19; and a manoeuvrable portion 22 extending, substantially perpendicular to root portion 21, from an end 23 of the root portion opposite connecting edge 19. Ends 23 have respective opposite, radially outer teeth 24, and manoeuvrable portions 22 have respective opposite, radially outer appendices 25 extending substantially parallel to teeth 24.

[0016] Supporting seats 16 are formed through respective diametrically opposite hollow bodies 26 carried by lateral wall 9 and above tabs 15.

[0017] Valve body 3 (Figures 1-3) comprises a tubular member 29 (which also acts as an overflow pipe) housed to slide along axis A inside slide seat 13 in vessel 8, and having, at the bottom, a shutter 30 which cooperates with

fluidtight seat 7 to close drain hole 6.

[0018] Tubular member 29 is adjustable in length, being defined by two telescopic tubes 31, 32. More specifically, tubular member 29 comprises a first tube 31 having shutter 30 and two diametrically opposite, radially inner pins 33; and a second tube 32 nested inside first tube 31 and having, at axially opposite ends, a sealing ring 34 and a connection 35 for an actuating member 36. An outer lateral surface 37 of tube 32 has two longitudinal, diametrically opposite guides 38, from which extend respective numbers of parallel circumferential grooves 39 equally spaced axially. The length of tubular member 29 is adjusted by sliding tube 32 inside tube 31, with pins 33 sliding inside guides 38; and then rotating tubes 31, 32 with respect to each other about axis A, so that pins 33 click inside respective grooves 39 to secure tubes 31, 32 to each other.

[0019] With reference to Figures 2, 3 and 5, valve assembly 1 also comprises a float 40 housed inside and close to the bottom of vessel 8 (i.e. close to bottom wall 10); and reversible connecting means 41 for selectively connecting-disconnecting float 40 and valve body 3 as the water level in vessel 8 varies.

[0020] More specifically, float 40 is connected to vessel 8, and is movable to selectively engage valve body 3 as the water level in vessel 8 varies.

[0021] Float 40 is hinged to vessel 8 by two pins 42 inserted inside respective aligned holes 43 formed in lateral wall 9 of vessel 8, and rotates about an axis of rotation defined by pins 42 and substantially perpendicular to axis A.

[0022] Float 40 comprises a double-walled, sector-shaped float body 44 having two aligned, parallel sides 45 joined by two concentric, respectively radially inner and radially outer, curved walls 46, 47, and by an arc-shaped top wall 48. Sides 45 comprise respective bottom portions 51 substantially perpendicular to arc-shaped top wall 48; and respective sloping portions 52.

[0023] Float body 44 is positioned radially outwards of and substantially coaxial with valve body 3 inside vessel 8; and pins 42 (defining, together with holes 43, hinge means for hinging float 40 to vessel 8) are located at the bottom end of float body 44 - more specifically, close to respective bottom edges 53 of float body 44 and close to sides 45.

[0024] Reversible connecting means 41 comprise a catch 54 formed on the top end of float body 44, located eccentrically with respect to pins 42, and for engaging a corresponding latch 55 on valve body 3 to secure float 40 axially to valve body 3.

[0025] In the example shown, catch 54 is defined by a step formed in the radially inner curved wall 46 of float body 44, and latch 55 is defined by a tooth projecting radially from an outer lateral wall of tubular member 29 (more specifically, from a wall portion of tube 32 outside tube 31).

[0026] As described below, float 40 is designed to selectively assume a first and a second operating position,

when the water in vessel 8 is above and below a predetermined level H respectively.

[0027] Control assembly 4 (Figure 1) comprises a button 60 fixable, for example, to a lid of the tank, and connected by a known slide (not shown) to a lever 61 engaging an eye 62 of actuating member 36.

[0028] Operation of valve assembly 1 is shown schematically in Figure 6.

[0029] Float 40 is designed to selectively assume a first and a second operating position:

- in the first operating position (Figures 6A and 6B), catch 54 interferes axially with latch 55, so that float 40 engages valve body 3 : valve body 3 can slide upwards along axis A, but is prevented from sliding downwards along axis A by catch 54 axially engaging latch 55;
- in the second operating position (Figures 6C and 6D), catch 54 does not interfere axially with latch 55, so that float 40 does not engage valve body 3 : valve body 3 can slide upwards and downwards along axis A, by virtue of catch 54 not engaging latch 55 axially.

[0030] When the tank is full (Figure 6A), float 40 is buoyed up in the first operating position by the water in the tank.

[0031] To drain off the water, the user presses button 60 to raise valve body 3 by means of lever 61 and actuating member 36; upward slide of valve body 3 along axis A is not impeded by catch 54 (Figure 6B); water flows out of the tank through drain hole 6; and downward slide of valve body 3 to close drain hole 6 is prevented by float 40 being connected to valve body 3 by catch 54 engaging latch 55 (Figure 6B).

[0032] When the water falls below the predetermined level (Figure 6C), float 40, no longer being buoyed up, assumes the second operating position by force of gravity, thus allowing valve body 3 to continue sliding down, also by force of gravity, to close drain hole 6 by means of shutter 30 (Figure 6C).

[0033] At this point, the tank is filled, and the water restores float 40 to its original position (Figure 6A).

[0034] Figure 7 shows valve assembly 1 equipped to drain all or part of the water from the tank.

[0035] With respect to the above description, valve assembly 1 comprises a modified control assembly 4, an additional float 65, and a frame 66 adjustable in height with respect to structure 2 to support control assembly 4.

[0036] Additional float 65 is fitted integrally to valve body 3. More specifically, additional float 65 is substantially toroidal, surrounds tubular member 29, and is connected, for example, to tube 32 by two radially inner, diametrically opposite pins 67 engaging a selected pair of grooves 39 on tube 32, so that the position of additional float 65 along tubular member 29 can also be adjusted by means of guides 38 and grooves 39 already provided to adjust the length of tubular member 29.

[0037] Frame 66 comprises two posts 68 extending

parallel to axis A; and an end cross member 69. Posts 68 have respective successions of parallel transverse projections 70 spaced along axis A and defining respective successions of aligned seats 71. Projections 70 on posts 68 are aligned with and face one another, so that each seat 71 on one post 68 is aligned with a seat 71 on the other post 68.

[0038] Posts 68 are inserted through supporting seats 16, and teeth 24 engage respective seats 71 to support frame 66 on structure 2. The position of frame 66 with respect to structure 2 is adjusted by simply pressing appendices 25 towards each other (radially inwards) to flex flexible tabs 15 inwards and release teeth 24 from seats 71; with appendices 25 still pressed, posts 68 are then slid, inside supporting seats 16, into the desired position; and appendices 25 are then released, so that tabs 15 spring back into the original position, and teeth 24 engage another pair of seats 71.

[0039] Control assembly 4 comprises a double lever 72 hinged to frame 66 and having an arm 73, which slides along axis A and cooperates with a slide 74, which in turn slides inside a support 75 fitted to cross member 69; slide 74 is connectable (in known manner not shown) to two buttons (not shown); when one or the other of the buttons is pressed, slide 74 is moved different distances along axis A to respectively drain all or part of the water from the tank, using additional float 65.

Claims

1. A flush tank flush valve assembly (1) comprising a supporting structure (2) having a vessel (8); a valve body (3) sliding along an axis (A) inside the vessel and having a shutter (30) cooperating with a fluidtight seat (7); and a float (40) housed in the vessel and cooperating with the valve body; the valve assembly being **characterized in that** the float (40) is connected to the vessel (8) and movable to selectively engage the valve body (3).
2. A valve assembly as claimed in Claim 1, **characterized by** comprising reversible connecting means (41) for selectively connecting-disconnecting the float (40) and the valve body (3) as the water level inside the vessel (8) varies.
3. A valve assembly as claimed in Claim 1 or 2, **characterized in that** the float (40) is hinged to the vessel (8) to rotate about an axis of rotation substantially perpendicular to said axis (A).
4. A valve assembly as claimed in one of the foregoing Claims, **characterized in that** the float (40) comprises, at one end, hinge means (42, 43) for hinge connection to the vessel (8), and, at the other end, a catch (54) for engaging a corresponding latch (55) on the valve body (3) to secure the float axially to the valve body.
5. A valve assembly as claimed in one of the foregoing Claims, **characterized in that** the float (40) is designed to selectively assume a first operating position, in which the float (40) engages the valve body (3) and prevents downward movement of the valve body along the axis (A) when the water in the vessel (8) is above a predetermined level, and a second operating position, in which the float (40) does not engage the valve body (3) when the water in the vessel (8) falls below said level.
6. A valve assembly as claimed in one of the foregoing Claims, **characterized in that** the float (40) is located close to the bottom of the vessel (8).
7. A valve assembly as claimed in one of the foregoing Claims, **characterized in that** the float (40) comprises a sector-shaped float body (44) located radially outwards of and substantially coaxial with the valve body (3).
8. A valve assembly as claimed in one of the foregoing Claims, **characterized in that** the supporting structure (2) comprises a height-adjustable frame (66) for supporting a control assembly (4) connected to the valve body (3).
9. A valve assembly as claimed in Claim 8, **characterized in that** the frame (66) comprises two posts (68) having respective successions of aligned seats (71); and the supporting structure (2) comprises two opposite teeth (24) for engaging a selected pair of said seats (71).
10. A valve assembly as claimed in Claim 9, **characterized in that** the teeth (24) are carried by respective flexible tabs (15) to selectively engage and release the respective seats (71).
11. A valve assembly as claimed in Claim 10, **characterized in that** the tabs (15) are defined by respective wall portions (17) of the supporting structure (2); each tab (15) being bounded by a contour (18) cut through a lateral wall (9) of the supporting structure (2), and being connected to said lateral wall (9) solely by a connecting edge (19).
12. A valve assembly as claimed in Claim 11, **characterized in that** the teeth (24) are located at respective ends of the tabs (15) opposite the connecting edges (19).
13. A valve assembly as claimed in one of Claims 10 to 12, **characterized in that** each tab (15) is substantially L-shaped, and comprises a root portion (21) and a manoeuvrable portion (22) substantially per-

pendicular to each other.

14. A valve assembly as claimed in Claim 13, **characterized in that** the manoeuvrable portions (22) of the tabs (15) have respective opposite appendixes (25) extending substantially parallel to the teeth (24).

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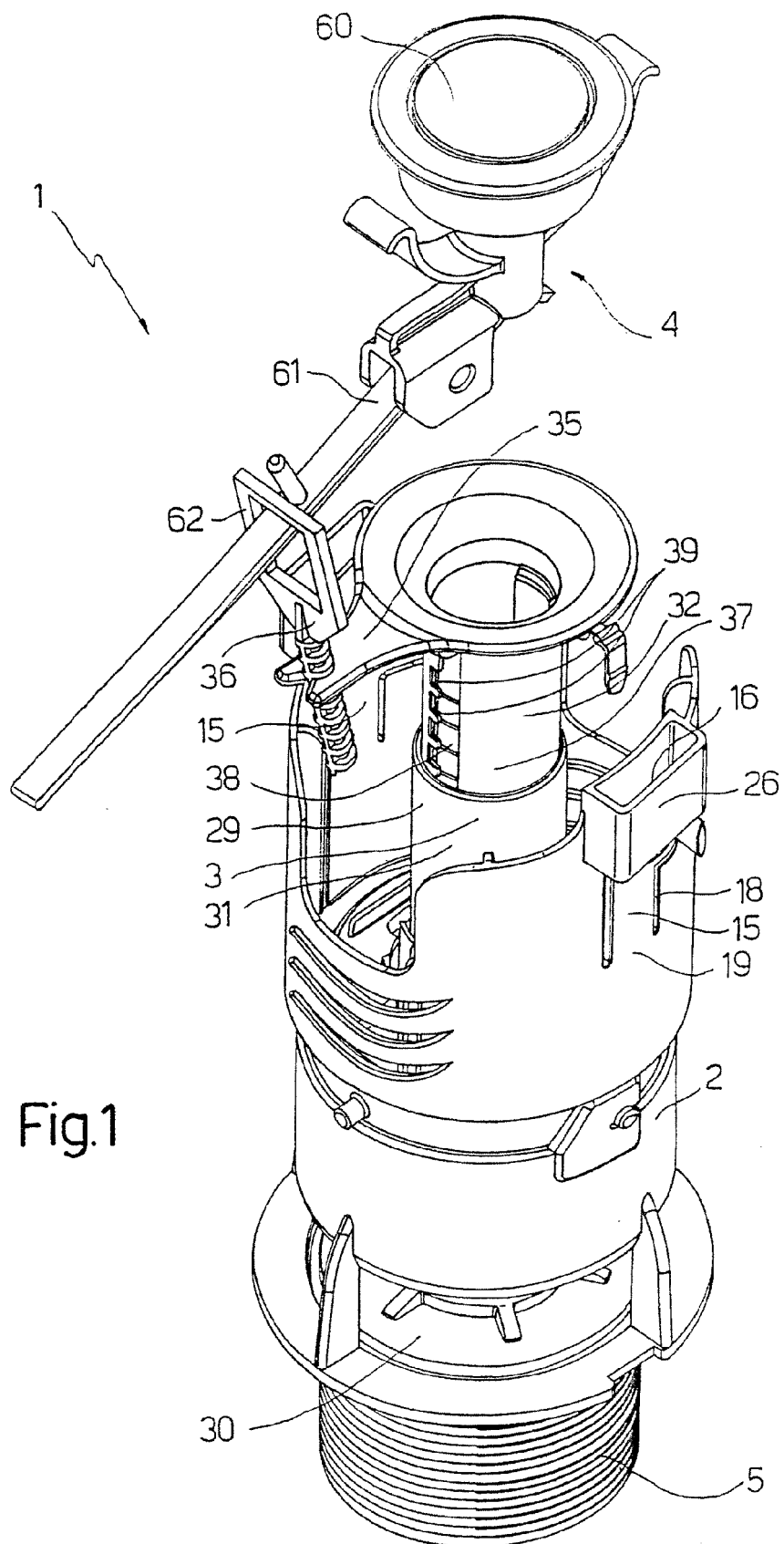
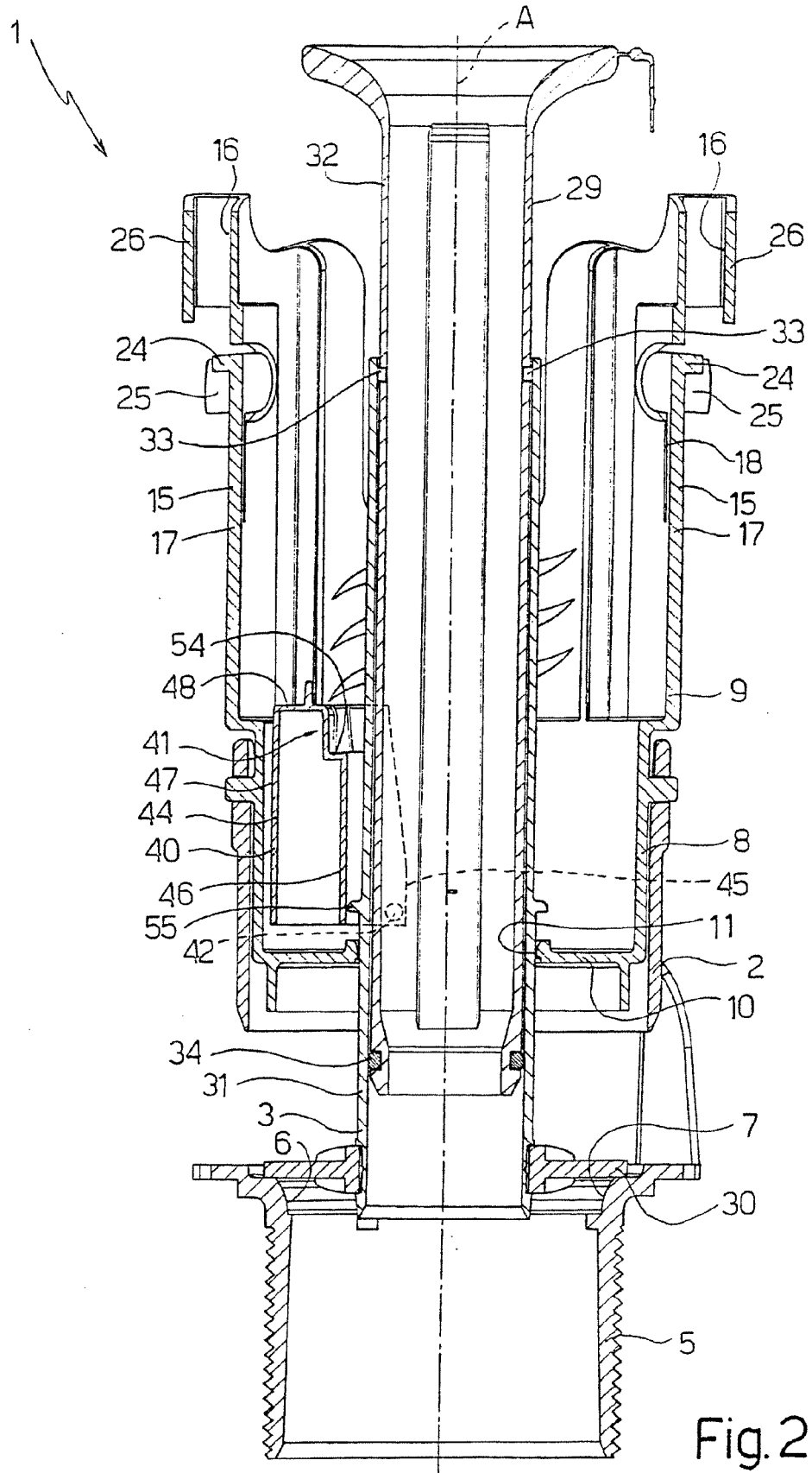


Fig.1



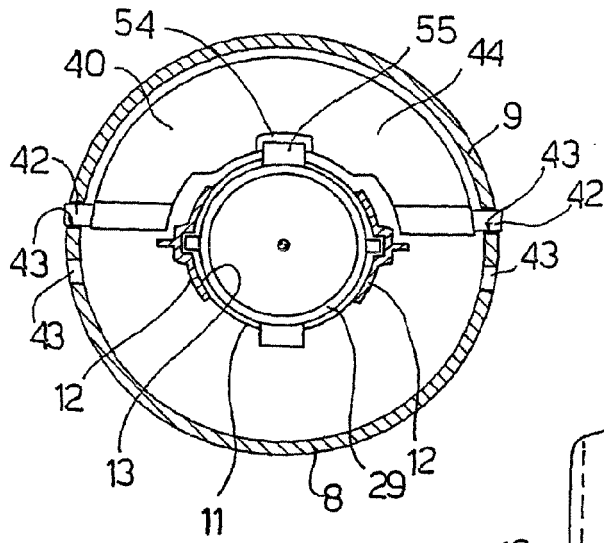


Fig.3

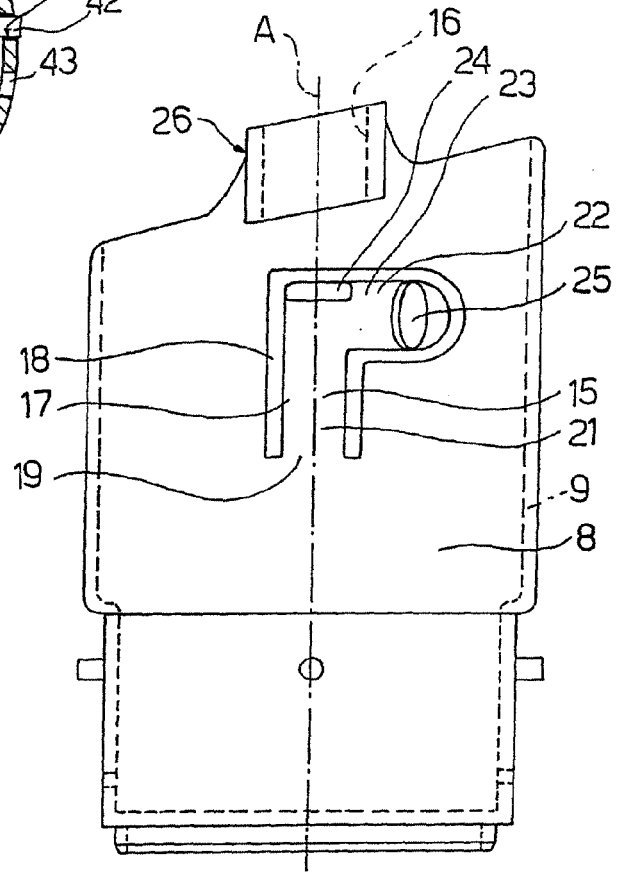


Fig.4

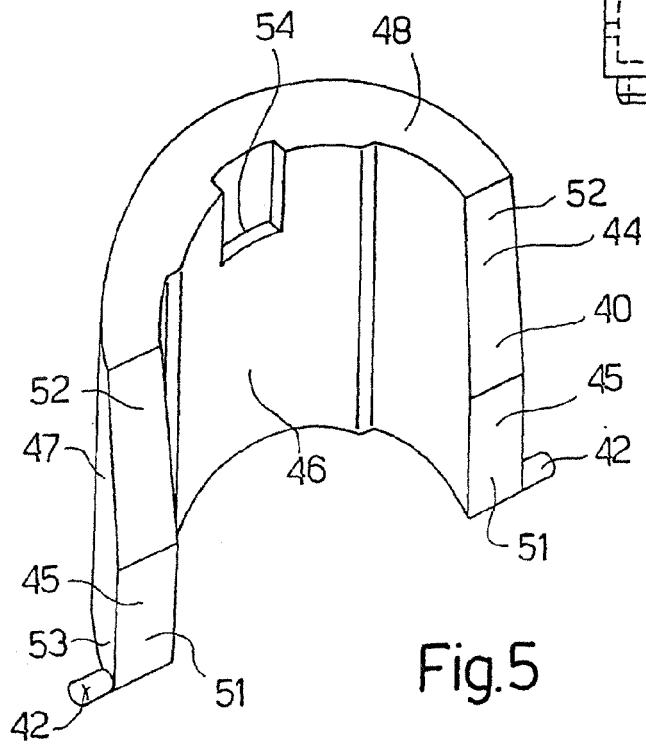


Fig.5

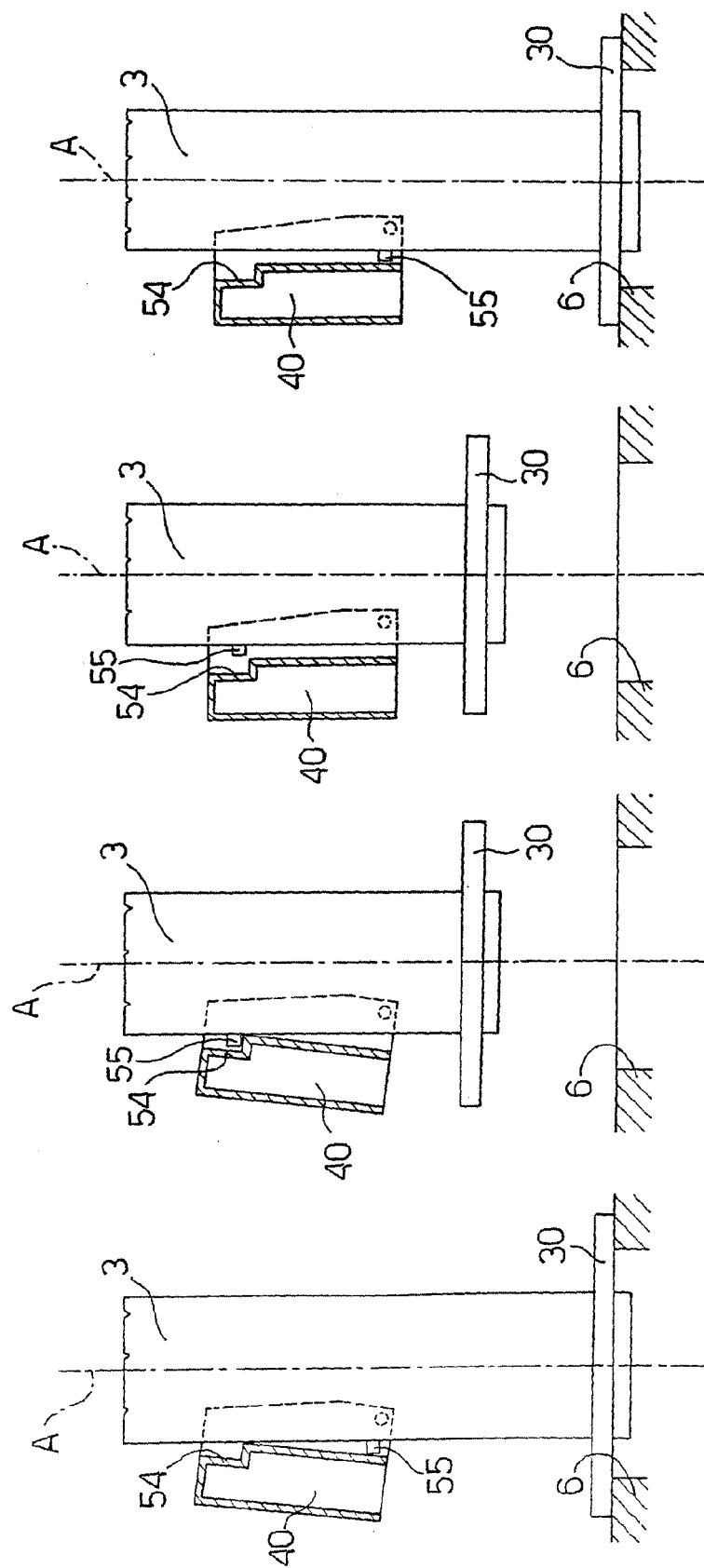


Fig.6A

Fig.6B

Fig.6C

Fig.6D

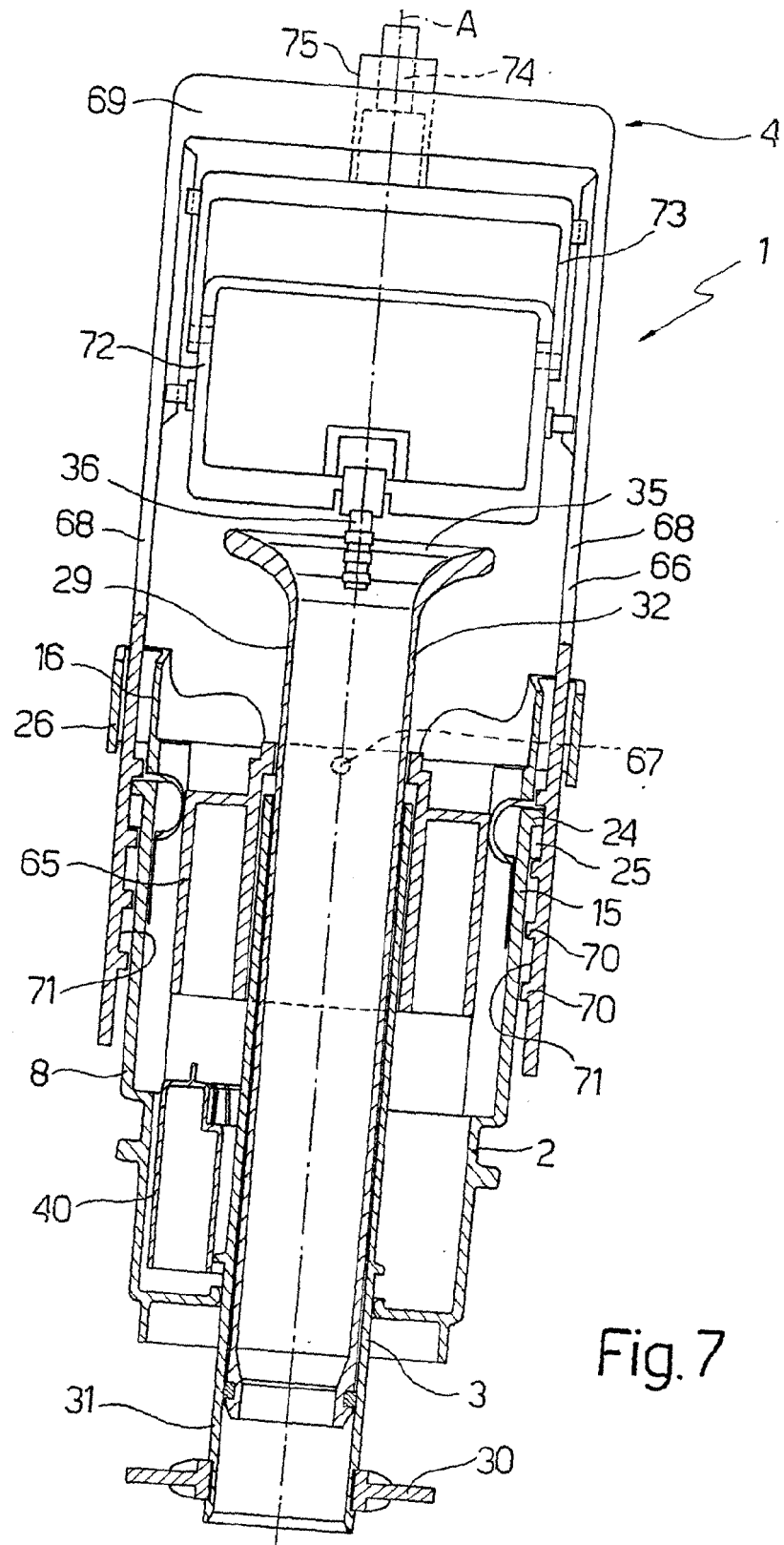


Fig. 7