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(54) Discharge device for a flush tank

(57) A discharge device (1) for a flush tank, designed to selectively permit full or partial discharge of the water in the flush tank, and having a main valve (5) for selectively opening and closing at least one drain hole (4) in the flush tank; a float (25) housed movably inside a vessel (8) fittable integrally to the flush tank; stop means (26) for arresting the float (25) and connected integrally to the main valve (5); auxiliary valve means (19) for selectively opening and closing the vessel (8) to vary the amount of water in the vessel and so reduce the thrust exerted on the main valve (5) by the buoyancy of the float (25); and reversible connecting means (31, 32, 35, 36) for reversibly connecting the auxiliary valve means (19) and the main valve (5) when partial discharge is activated.

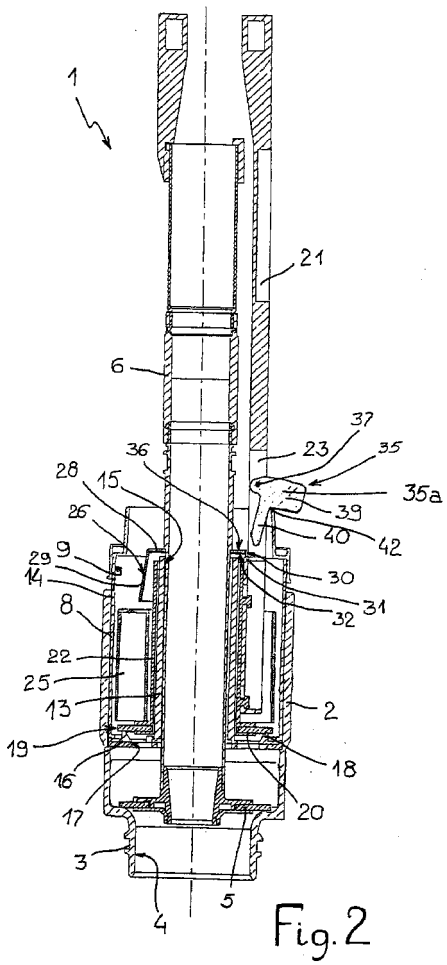

Fig. 2

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Description

[0001] The present invention relates to a discharge device for a flush tank, of the type permitting full or partial discharge of the water in the tank.

[0002] Numerous flush tank discharge devices are known which, to reduce water consumption, permit full or partial discharge as required. Such devices normally comprise a discharge valve fitted to the bottom end of a movable pull member (normally the overflow pipe of the tank itself) and which, to discharge water from the tank, is lifted out of its seat using either of two control levers; and the two discharge modes (full or partial) are achieved by varying the speed with which the valve, once raised, closes by force of gravity.

[0003] Devices are known, for example, in which, when raised using the full-discharge lever, the discharge valve is kept open by a float until all the water is drained out of the tank; conversely, for partial discharge, the valve is raised together with an additional weight which, as the valve closes, acts on the valve, in opposition to the thrust exerted by the float, to close the valve faster.

[0004] Two floats are also known to be used, one acting on the closing valve in both modes, and the other only for partial discharge.

[0005] Generally speaking, therefore, discharge devices of the type briefly described above call for a float; an auxiliary member (additional weight or float) for altering the thrust exerted by the float as the valve closes; and appropriate reversible connecting means between the auxiliary member and the valve. Such devices therefore involve a relatively large number of components and are relatively bulky and unreliable.

[0006] It is an object of the present invention to overcome the aforementioned drawbacks of known discharge devices by providing a flush tank discharge device permitting effective, reliable, full or partial discharge of the water in the tank. It is a further object of the invention to provide a discharge device comprising a relatively small number of component parts, and which is easy to operate, reliable, extremely compact, cheap to produce, and easy to install.

[0007] According to the present invention, there is provided a discharge device for a flush tank, designed to selectively permit full or partial discharge of the water in said flush tank; the device comprising a main valve for selectively opening and closing at least one drain hole in said flush tank; a float; and stop means for arresting said float and connected integrally to said main valve; characterized by also comprising a vessel fittable integrally to said flush tank at said at least one drain hole in said flush tank, and having, internally, a flood chamber housing said float in movable manner; and auxiliary valve means for selectively opening and closing said vessel to vary the amount of water in said flood chamber.

[0008] The device according to the invention also comprises reversible connecting means between said main valve and said auxiliary valve means, for reversibly connecting said auxiliary valve means and said main valve when partial discharge of the water in said flush tank is activated.

[0009] The discharge device according to the invention therefore provides, simply and effectively, for selectively discharging different amounts of water from the flush tank to which it is fitted. The device also comprises a relatively small number of component parts (in particular, only one float), is extremely compact, can be fitted quickly and easily to flush tanks of different sizes, and is cheap to produce, easy to operate and reliable.

[0010] The amount of water discharged in partial-discharge mode can also be regulated easily and effectively by varying the section of the drain openings in the flood chamber in which the float moves, and by appropriately sizing the float itself in relation to the weight of the other component parts of the device.

[0011] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a flush tank discharge device in accordance with the invention;

Figure 2 shows a section along line II-II of the Figure 1 device in the rest position;

Figure 3 shows a longitudinal section of the Figure 1 device in full discharge mode;

Figure 4 shows a longitudinal section of the Figure 1 device in partial-discharge mode.

[0012] Number 1 in Figures 1 and 2 indicates as a whole a discharge device for a known flush tank not shown for the sake of simplicity.

[0013] Device 1 comprises a supporting structure 2 fittable to the flush tank, e.g. by inserting a tubular end portion 3 of supporting structure 2 in fluidtight manner inside a drain hole in the flush tank; in which case, a bottom opening in tubular portion 3 of supporting structure 2 defines the drain hole of the flush tank, and is therefore indicated hereinafter as drain hole 4 for the sake of simplicity.

[0014] Device 1 also comprises a main valve 5 for closing drain hole 4, and which is fitted to the bottom end of a pipe 6 housed in sliding manner inside supporting structure 2 and possibly formed in a number of pieces connected to one another. As in a known solution, pipe 6 also acts as an overflow pipe of the flush tank.

[0015] Supporting structure 2 has openings 7 at the bottom, through which water flows from the flush tank to drain hole 4, and is fitted inside with a substantially toroidal vessel 8 having an inner flood chamber 9 defined by an inner lateral wall 13 and an outer lateral wall 14 of vessel 8, which are substantially cylindrical and coaxial with each other. Inner lateral wall 13 defines, internally, a seat 15 in which pipe 6 slides; and

vessel 8 is open at the top and closed at the bottom by an annular bottom wall 16 in which is formed a through, e.g. annular, outflow opening 17 defined by an annular sealing edge 18. In one variation, a number of through outflow openings, e.g. arranged side by side circumferentially, are formed in bottom wall 16 of vessel 8.

[0016] Whichever the case, device 1 according to the invention comprises auxiliary valve means 19 for selectively opening and closing outflow opening 17 in vessel 8. In the example shown, auxiliary valve means 19 comprise a substantially annular shutter member 20, which cooperates with sealing edge 18 to close outflow opening 17, and is connected integrally to a pull member 21 slidable with respect to vessel 8. More specifically, pull member 21 comprises a cylindrical body 22 and a control rod 23; cylindrical body 22 is coaxial with, located radially outwards of, and slides axially with respect to, inner lateral wall 13 of vessel 8, and is fitted at the bottom end with shutter member 20; and control rod 23 is fitted to cylindrical body 22 and extends vertically and parallel to pipe 6 at the opposite end to shutter member 20.

[0017] A float 25, e.g. a known substantially toroidal type, is housed freely inside flood chamber 9.

[0018] Device 1 also comprises a stop member 26 for arresting float 25 and connected integrally to main valve 5. In the example shown, stop member 26 is defined by a collar 28 fitted integrally about pipe 6 at a predetermined distance from main valve 5, and from a peripheral edge of which a substantially truncated-cone-shaped lateral wall 29 extends downwards inside flood chamber 9 of vessel 8. Collar 28 also has a through opening 30 in which control rod 23 of pull member 21 is inserted in sliding manner; and control rod 23 comprises, beneath collar 28, a stop portion 31 of a transverse (radial or circumferential) extension greater than opening 30, so as to interfere axially with collar 28 and so push a corresponding first stop portion 32 of pipe 6 - defined, in the example shown, by a bottom surface of collar 28 - when pull member 21 is raised with respect to vessel 8, as explained later on.

[0019] Device 1 also comprises a connecting member 35 carried by pull member 21 and which pushes a corresponding second stop portion 36 of pipe 6 when pull member 21 is lowered with respect to vessel 8, as explained later on. In the example shown, second stop portion 36 of pipe 6 is defined by a top surface of collar 28 opposite the bottom surface 32.

[0020] More specifically, connecting member 35 is an oscillating body connected in articulated manner, at a pivot 37, to a support 38 supporting pull member 21 and located above stop member 26. Connecting member 35 is substantially L-shaped, and comprises a portion 39 eccentric with respect to pivot 37, and a catch 40 extending substantially perpendicularly with respect to eccentric portion 39.

[0021] Operation of device 1 according to the invention will now be described with reference to Figures 1 to 3.

[0022] Figure 2 shows device 1 in the rest position : main valve 5 is positioned closing drain hole 4; shutter member 20 closes outflow opening 17 of vessel 8; open-topped vessel 8 is immersed in the water inside the flush tank to which device 1 is fitted, so that flood chamber 9 of vessel 8 is full of water; float 25 is retained inside flood chamber 9 by stop member 26; the total weight of main valve 5 and pipe 6 is greater than the buoyancy of float 25; connecting member 35 is in a rest position 35a (Figure 2) in which eccentric portion 39 rests on a peripheral edge 42 of supporting structure 2, e.g. defined by a top edge of vessel 8, which defines a retaining member for retaining connecting member 35 in rest position 35a; and main valve 5 and auxiliary valve means 19 are therefore disconnected.

[0023] Figure 3 shows operation of device 1 when full discharge of the water in the flush tank is activated : by means of appropriate known actuating means, not shown for the sake of simplicity, pipe 6 and valve 5 fitted to it are raised to open drain hole 4 and allow the water in the flush tank to flow out; shutter member 20, on the other hand, remains closing outflow opening 17 in vessel 8 (fixed); and connecting member 35 remains in rest position 35a.

[0024] When the action of actuating means ceases, pipe 6 and main valve 5, the combined weight of which overcomes the buoyancy of float 25, move down to close drain hole 4. The downward movement of pipe 6, however, is slowed down by float 25, which is immersed inside flood chamber 9 full of water, and which exerts sufficient thrust to delay closure of main valve 5 until all the water in the flush tank has been discharged.

[0025] Figure 4 shows operation of device 1 when partial discharge of the water in the flush tank is activated : in this case, the actuating means (not shown) act directly on pull member 21, which is raised together with shutter member 20 to detach shutter member 20 from sealing edge 18 of outflow opening 17 in vessel 8 (fixed). As it moves up, pull member 21 also raises pipe 6, as stop portion 31 of pull member 21 contacts and pushes stop portion 32 of pipe 6, so that the same movement of pull member 21 provides for opening both outflow opening 17 in vessel 8 and drain hole 4 in the flush tank.

[0026] The upward movement of pull member 21 also releases connecting member 35 from retaining member 42. That is, when connecting member 35 is raised together with pull member 21, eccentric portion 39 is detached from peripheral edge 42 of vessel 8; and the weight of eccentric portion 39 is such as to automatically rotate connecting member 35 about pivot 37 until catch 40 comes to rest against pipe 6, thus setting connecting member 35 to the work position 35b shown in Figure 4.

[0027] When the action of actuating means ceases, both pipe 6 with main valve 5 and pull member 21 with shutter member 20 move down to respectively close

drain hole 4 in the flush tank and outflow opening 17 in vessel 8. In work position 35b, connecting member 35 reversibly connects main valve 5 and auxiliary valve means 19, by catch 40 of connecting member 35 pushing on second stop portion 36 of pipe 6, i.e. the top surface of collar 28.

[0028] As such, pull member 21 and shutter member 20 are also sustained, together with pipe 6, by the buoyancy of float 25. In this case, however, since vessel 8 is open at the bottom, the water inside flood chamber 9 flows out to reduce the thrust exerted by float 25, so that drain hole 4 is closed sooner by main valve 5, when only a predetermined portion of the water in the flush tank has been discharged.

[0029] The amount of water discharged in partial-discharge mode depends on the section of outflow opening or openings 17 (if more than one is provided) and hence on the speed with which pipe 6 and main valve 5 close drain hole 4 in opposition to the thrust exerted by float 25, as well as, obviously, on the sizing of float 25 and the other component parts of device 1.

[0030] Clearly, changes may be made to the device as described herein without, however, departing from the scope of the accompanying Claims.

Claims

1. A discharge device (1) for a flush tank, designed to selectively permit full or partial discharge of the water in said flush tank; the device comprising a main valve (5) for selectively opening and closing at least one drain hole (4) in said flush tank; a float (25); and stop means (26) for arresting said float (25) and connected integrally to said main valve (5); characterized by also comprising a vessel (8) fittable integrally to said flush tank at said at least one drain hole (4) in said flush tank, and having, internally, a flood chamber (9) housing said float (25) in movable manner; and auxiliary valve means (19) for selectively opening and closing said vessel (8) to vary the amount of water in said flood chamber (9).

2. A device as claimed in Claim 1, characterized by also comprising reversible connecting means (31, 32, 35, 36) between said main valve (5) and said auxiliary valve means (19), for reversibly connecting said auxiliary valve means (19) and said main valve (5) when partial discharge of the water in said flush tank is activated.

3. A device as claimed in Claim 2, characterized in that said vessel (8) is substantially toroidal; said flood chamber (9) being defined by an inner lateral wall (13) and an outer lateral wall (14) of said vessel (8), which are substantially cylindrical and coaxial with each other; said vessel (8) being open at the top and having, at the bottom, at least one outflow opening (17) defined by a sealing edge (18); and said auxiliary valve means (19) comprising at least one shutter member (20) which cooperates with said sealing edge (18) to close said at least one outflow opening (17) of said vessel (8).

4. A device as claimed in Claim 3, characterized in that said shutter member (20) is connected integrally to a movable pull member (21) activated from outside said flush tank and slidable with respect to said vessel (8).

5. A device as claimed in Claim 4, characterized in that said main valve (5) is fitted to a bottom end of a pipe (6); said pipe (6) being housed in sliding manner inside a seat (15) defined by said inner lateral wall (13) of said vessel (8); and said float (25) also being toroidal, and being housed freely inside said flood chamber (9).

6. A device as claimed in Claim 5, characterized in that said stop means comprise a stop member (26) fitted integrally to said pipe (6) at a predetermined distance from said main valve (5) and extending inside said flood chamber (9) of said vessel (8).

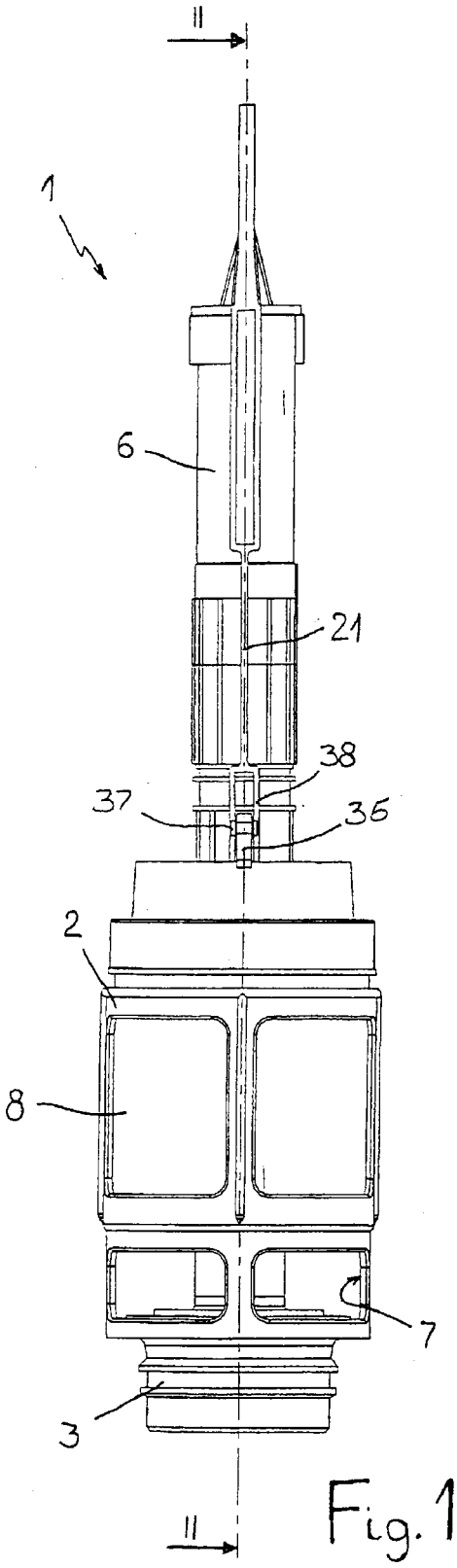
7. A device as claimed in Claim 6, characterized in that said reversible connecting means between said main valve (5) and said auxiliary valve means (19) comprise a stop portion (31) of said pull member (21), which pushes a corresponding first stop portion (32) of said pipe (6) when said pull member (21) is raised with respect to said vessel (8) to open the vessel; said reversible connecting means also comprising at least one connecting member (35) carried by said pull member (21) and which pushes a corresponding second stop portion (36) of said pipe (6) when said pull member (21) moves down with respect to said vessel (8).

8. A device as claimed in Claim 7, characterized in that said connecting member (35) selectively assumes a work position (35b) in which the connecting member pushes said second stop portion (36) of said pipe (6) to reversibly connect said main valve (5) and said auxiliary valve means (19), and a rest position (35a) in which said main valve (5) and said auxiliary valve means (19) are disconnected.

9. A device as claimed in Claim 8, characterized in that said connecting member (35) is an oscillating body connected in articulated manner, at a respective pivot (37), to a support (38) supporting said pull member (21), and comprising an eccentric portion (39) eccentric with respect to said pivot (37), and a catch (40); said vessel (8) having a retaining member (42) for retaining the oscillating said connecting member (35) and for maintaining said connecting

member (35) in said rest position (35a); and said eccentric portion (39) of said connecting member (35) automatically rotating said connecting member (35), when said connecting member (35) is released from said retaining member (42), so that said connecting member (35) assumes said work position (35b) in which said catch (40) engages said second stop portion (36) of said pipe (6).

10. A device as claimed in claim 9, characterized in that said connecting member (35) is substantially L-shaped; said catch (40) extending substantially perpendicularly with respect to said eccentric portion (39); and said first (32) and second (36) stop portion of said pipe (6) being defined by respective opposite surfaces of said stop member (26).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II

Fig. 1

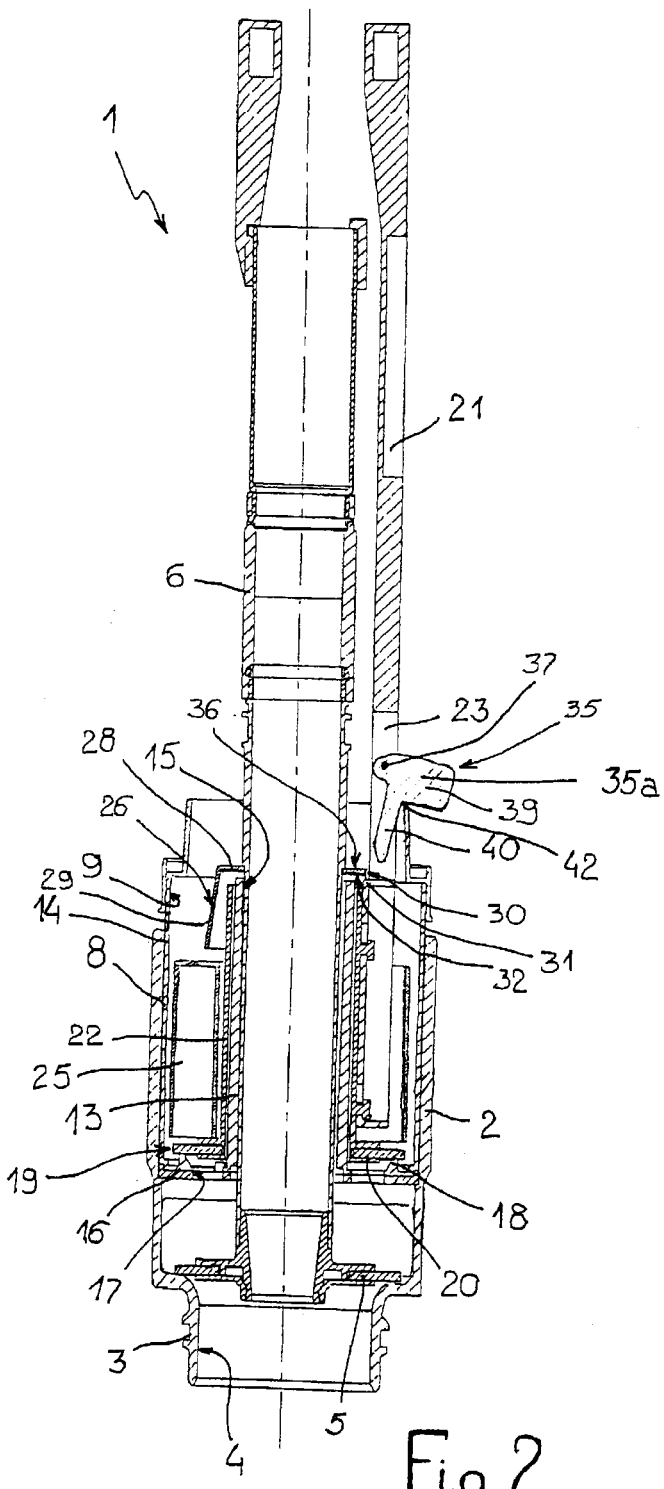
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Fig. 2

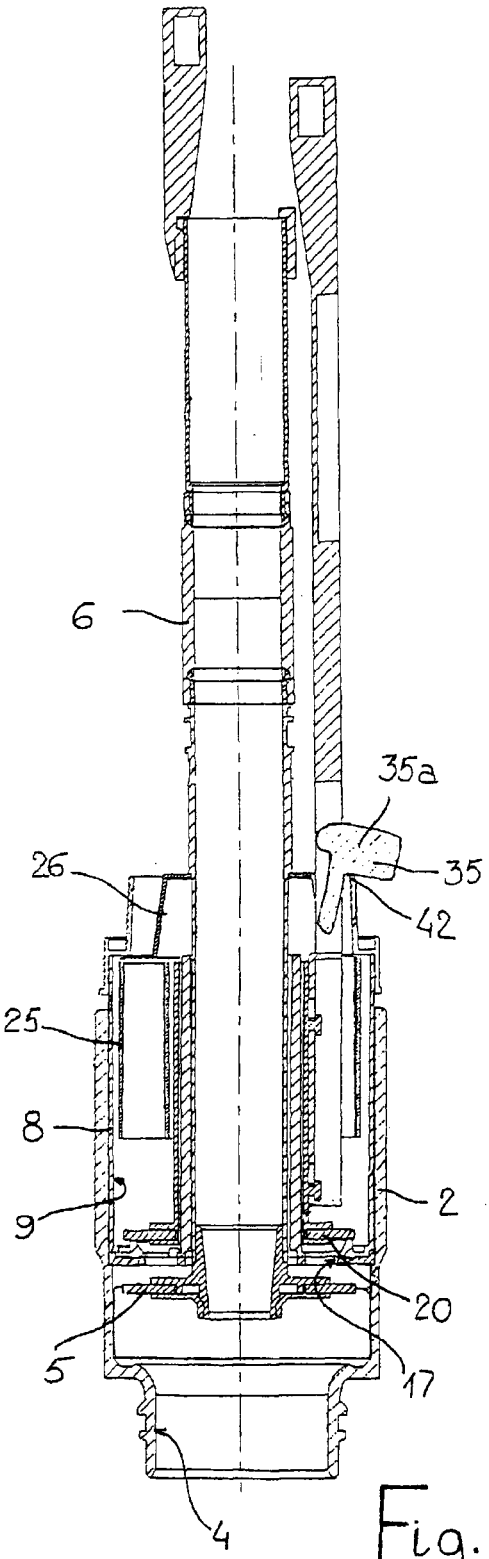
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Fig.3

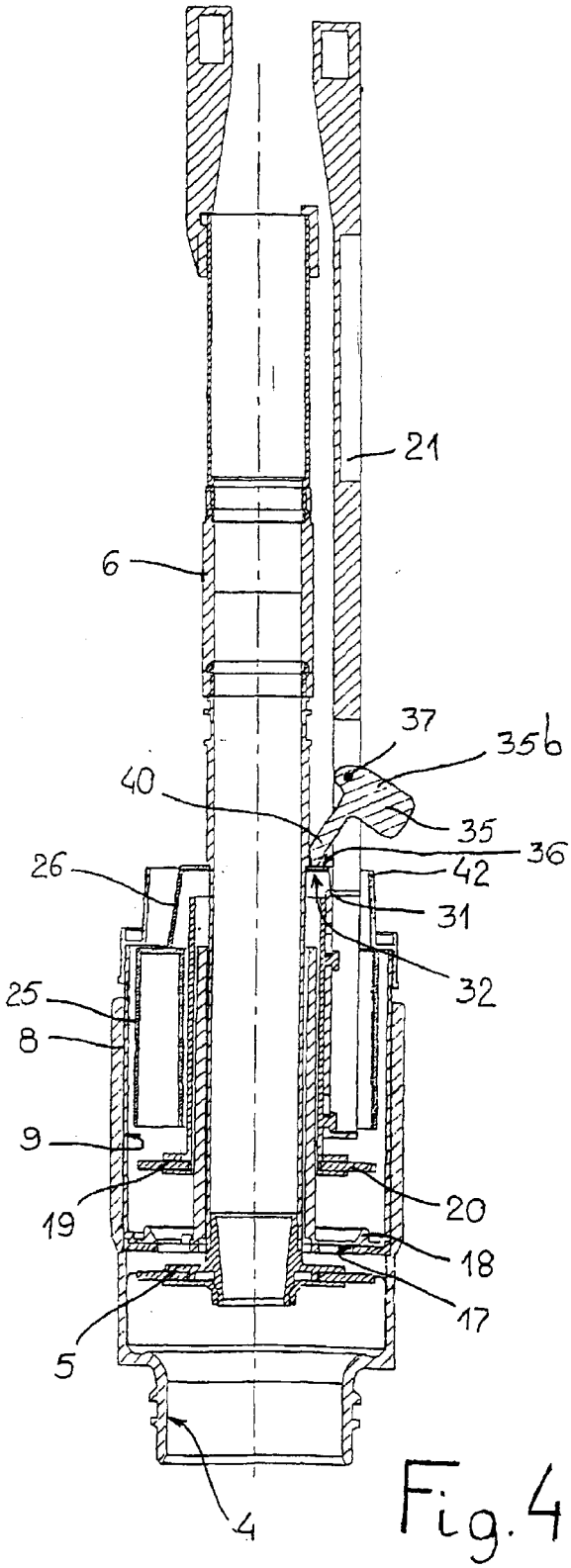
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Fig.4