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(54) Flush tank drain valve assembly with a water outflow regulating system

(57) A flush tank drain valve assembly (1) has a supporting structure (2) which includes a vessel (7); a valve body (3) which slides along an axis (A) and is associated with a float (31) housed inside the vessel (7); and a regulating system (5) for adjusting the water level inside the vessel (7); the regulating system (5) has a window (16) formed through a lateral wall (15) of the vessel (7), and a movable gate (38) for adjusting the opening of the window (16); the gate (38) is connected integrally to an adjusting rod (42) connected to the supporting structure (2) by a releasable coupling (43), so as to fix the rod (42) to the supporting structure (2) in at least two predetermined positions corresponding to respective operating positions of the gate (38) with respect to the window (16).

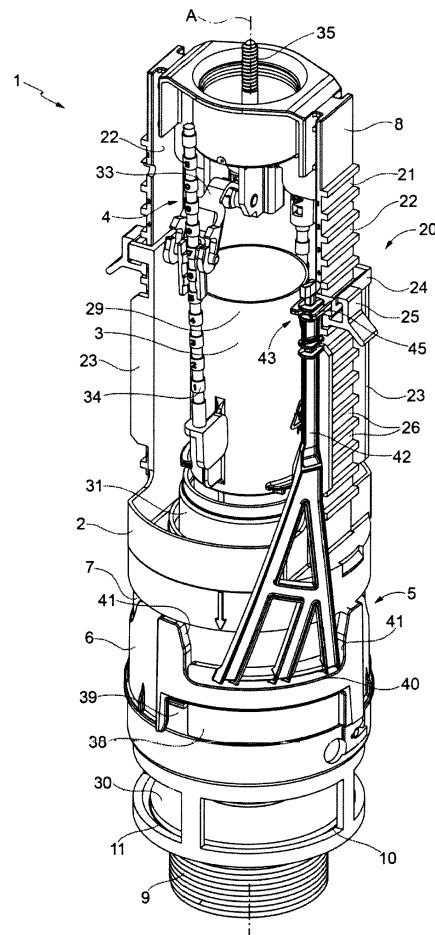


FIG. 1

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Description

[0001] The present invention relates to a flush tank drain valve assembly with a water outflow regulating system.

[0002] A drain valve assembly roughly comprises a supporting structure fixable to the bottom wall of the tank and having a drain hole bounded by a sealing seat, and a valve body (normally a tubular member that also acts as an overflow tube) housed slidably inside the supporting structure and having a shutter at the bottom, which cooperates with the sealing seat to close the drain hole; the valve body is raised by user-controlled actuators to drain the water from the tank, and optionally provides for draining all or only part of the water from the tank by adjusting the closing speed of the shutter by means, for example, of one or more floats and/or additional weights acting on the valve body.

[0003] Some known valve assemblies, as illustrated, for example, in EP1795661, permit initial adjustment (when installing the flush tank) of the amount of water discharged.

[0004] Known valve assemblies of this type, however, still leave room for improvement, especially in terms of easy, low-cost manufacture, reliable operation, and easy, effective use.

[0005] It is an object of the present invention to provide a flush tank drain valve assembly, with a water outflow regulating system, which is extremely simple, fully effective, and enables easy, precise adjustment of the amount of water discharged.

[0006] According to the present invention, there is provided a flush tank drain valve assembly, with a water outflow regulating system, substantially as defined in the attached Claim 1 and, as regards its preferred aspects, in the dependent Claims.

[0007] The drain valve assembly according to the invention is extremely cheap and easy to produce, is simple, safe, and reliable operation-wise, and permits easy, fast, precise adjustment of the amount of water discharged.

[0008] More specifically, the valve assembly according to the invention is equipped with a regulating system adjustable from above without removing the valve assembly from the tank.

[0009] A non-limiting embodiment of the invention will be described by way of example with reference to the attached drawings, in which :

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

Figure 2 shows a view in perspective of a component part of, and detached from, the Figure 1 valve assembly;

Figure 3 shows a view in perspective of a detail of the Figure 1 valve assembly;

Figure 4 shows a view in perspective of the Figure

1 valve assembly in a second operating configuration;

Figure 5 shows a view in perspective of a detail of the Figure 4 valve assembly.

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[0010] Number 1 in Figure 1 indicates as a whole a drain valve assembly, with a water outflow regulating system, for a known flush tank (not shown).

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[0011] Valve assembly 1 extends substantially along an axis A (vertical in use), and comprises a supporting structure 2, a valve body 3 which extends and slides along axis A inside supporting structure 2, an actuating mechanism 4 for operating valve body 3, and a water outflow regulating system 5.

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[0012] Supporting structure 2 comprises a main body 6, which inside defines a vessel 7 in which valve body 3 is housed and slides, and a support 8 which supports mechanism 4 and, via mechanism 4, valve body 3.

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[0013] Main body 6 is fixable to the bottom wall of the tank by, for example, a threaded sleeve 9 having a drain hole 10 bounded by a sealing seat 11.

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[0014] As shown in detail in Figure 2, vessel 7 is cup-shaped, is open at the top, and is closed at the bottom by a bottom wall 12 with a centre hole 13 through which valve body 3, housed inside a tubular guide 14, is fitted.

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[0015] Vessel 7 has a lateral wall 15 which, for example (though not necessarily), is substantially cylindrical; and lateral wall 15 has a through window 16 located close to bottom wall 12 and, for example, elongated parallel to bottom wall 12. For example, window 16 is substantially rectangular, with its long sides parallel to bottom wall 12. And an annular chamber 17 is defined inside vessel 7, between lateral wall 15 and guide 14.

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[0016] In the non-limiting example shown, supporting structure 2 has a height adjusting mechanism 20 comprising an adjustable frame 21 connecting support 8 to main body 6; and frame 21 can be fixed in various predetermined positions with respect to main body 6, to adjust the overall height of valve assembly 1 along axis A.

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[0017] More specifically, mechanism 20 comprises two diametrically opposite uprights 22 projecting downwards from support 8 and extending along respective longitudinal axes parallel to axis A.

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[0018] Uprights 22 slide inside respective guides 23, which project upwards, substantially parallel to axis A, from main body 6, and which, at respective top free ends 24, have respective releasable locking members 25 which selectively secure and release support 8 axially to/from main body 6, to lock or allow uprights 22 to slide inside guides 23. In the non-limiting example shown, each upright 22 has a succession of slots 26 spaced longitudinally apart along upright 22.

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[0019] As shown in more detail in Figure 3, locking members 25 have respective elastically deformable cogs 27 for selectively engaging slots 26; each cog 27 has an operating tab 28 projecting radially outwards of main body 6 from cog 27 and operated manually by the user; acting on tabs 28, the user moves cogs 27 away from

uprights 22 to release cogs 27 from slots 26 and allow uprights 22 to slide inside guides 23; and, after adjusting the height of valve assembly 1, the user releases tabs 28 to engage respective cogs 27 inside another pair of slots 26 and so lock frame 21.

[0020] Valve body 3 comprises a tube 29, which also functions as an overflow tube of the flush tank, and a shutter 30 located at the bottom end of tube 29 and co-operating with sealing seat 11. Valve body 3 has at least one float 31, housed inside vessel 7 and more specifically inside chamber 17 and which slides along axis A inside vessel 7.

[0021] Valve body 3 may have or be connected to a number of known additional floats or weights (not shown for the sake of simplicity), which are selectively engaged in known manner by valve body 3 to adjust the closing speed of shutter 30 and so discharge all or only part of the water from the tank.

[0022] Tube 29 is connected to mechanism 4, which comprises a lever 33 hinged to support 8 and connected to tube 29 by a hooked rod 34; and lever 33 is operated by one or more movable rods 35 (e.g. movable parallel to axis A) connected to respective known pushbuttons (not shown for the sake of simplicity) and housed inside support 8.

[0023] Water outflow regulating system 5 comprises vessel 7 housing float 31 of valve body 3, window 16 formed through lateral wall 15 of vessel 7, and a gate 38 closing window 16.

[0024] Gate 38 slides substantially parallel to axis A (substantially vertically) to adjust the opening, i.e. the open flow section (water flow cross section) of window 16 and therefore the amount of water inside vessel 7. More specifically, gate 38 is located on an outer surface 39 of lateral wall 15, is shaped to slide on surface 39, and is larger than window 16.

[0025] Gate 38 is housed and slides inside a guide slot 40 located on surface 39 and having two opposite lateral shoulders 41 for guiding the vertical movement (parallel to axis A) of gate 38.

[0026] Gate 38 is movable selectively into at least two operating positions with respect to window 16, in which window 16 has two different water flow sections.

[0027] For example, gate 38 is movable into a closed position (Figure 1), in which it fully closes window 16, and an open position (Figure 4), in which it leaves window 16 fully or partly open.

[0028] Gate 38 may also be designed to assume a plurality of operating positions corresponding to different openings (i.e. different open flow sections) of window 16.

[0029] With reference also to Figures 3-5, gate 38 is connected integrally to an adjusting rod 42 projecting upwards, substantially parallel to axis A, from gate 38; and rod 42 and supporting structure 2 are connected by a releasable coupling 43 to fix rod 42 to supporting structure 2 in at least two operating positions corresponding to respective operating positions of gate 38 with respect to window 16.

[0030] Coupling 43 comprises a plurality of - in particular, at least two - seats 44 spaced apart axially, parallel to axis A; and at least one catch element 45 for selectively engaging seats 44 (i.e. for engaging a chosen seat 44). Seats 44 and catch element 45 are carried on rod 42 and supporting structure 2 respectively, or vice versa.

[0031] In the non-limiting example shown, coupling 43 comprises a plurality of seats 44, located at the top end 46 of rod 42 and spaced apart axially along rod 42; each seat 44 is defined by two facing axial shoulders 47 defined by respective radial flanges located along rod 42; and catch element 45 comprises a C-shaped fork 48 projecting laterally from guide 23 - more specifically, from the free end 24 of guide 23 - and designed to click onto rod 42 inside a seat 44, between two shoulders 47.

[0032] Catch element 45 is designed to engage each seat 44 between two shoulders 47 and to click onto rod 42, so as to secure rod 42 to supporting structure 2 and support gate 38 axially at different heights by means of rod 42.

[0033] Rod 42 is designed with a predetermined amount of transverse flexibility, i.e. is flexible transversely. For example, rod 42 is made of plastic (polymer material) and is thin enough to flex crosswise.

[0034] When installing valve assembly 1, after adjusting the height (measured along axis A) of valve assembly 1 by means of height adjusting mechanism 20, to adapt valve assembly 1, if necessary, to the size of the tank, the user adjusts the amount of water discharged by means of regulating system 5.

[0035] To adjust the amount of water discharged, the user releases coupling 43 and moves gate 38 using rod 42.

[0036] Coupling 43 is released by simply pulling end 46 of rod 42 radially (i.e. horizontally, crosswise to axis A) to release rod 42 from catch element 45. The flexible nature of rod 42 allows end 46 to flex to free rod 42 from catch element 45.

[0037] Once coupling 43 is released, rod 42 is slidable axially, parallel to axis A, together with gate 38 to move gate 38 into its various operating positions with respect to window 16, and so adjust the opening of window 16.

[0038] Once set the chosen position, rod 42 is inserted back into catch element 45, again moving horizontally, crosswise to axis A, to secure rod 42 once more to supporting structure 2.

[0039] The positions of gate 38 are marked by user-visible wording or symbols (indicating, for example, the amount of water discharged in each position).

[0040] Adjusting the opening of window 16 adjusts the water level inside vessel 7, and therefore the operating level of float 31 housed inside vessel 7, and the amount of water discharged. Regulating system 5 thus provides for adjusting the water level inside vessel 7 and therefore the operating level of float 31 housed inside it.

[0041] Clearly, changes may be made to what is described and illustrated herein without, however, departing from the scope of the invention as defined in the ac-

companying Claims.

Claims

1. A flush tank drain valve assembly (1) with a water outflow regulating system, extending substantially along an axis (A) and comprising a supporting structure (2) which includes a vessel (7), a valve body (3) which slides along the axis (A) and is associated with a float (31) housed inside the vessel (7), and a regulating system (5) for adjusting the water level inside the vessel (7); the regulating system (5) comprising a window (16), formed through a lateral wall (15) of the vessel (7), and a gate (38) for closing the window (16) and movable to adjust the opening of the window (16); the valve assembly being **characterized in that** the gate (38) is connected integrally to an adjusting rod (42) projecting upwards, substantially parallel to the axis (A), from the gate (38); and the rod (42) and the supporting structure (2) are connected by a releasable coupling (43), so as to fix the rod (42) to the supporting structure (2) in at least two predetermined positions corresponding to respective operating positions of the gate (38) with respect to the window (16).
2. A valve assembly as claimed in Claim 1, wherein the gate (38) is movable to assume selectively at least two operating positions with respect to the window (16), in which the window (16) has two different water flow sections; and the rod (42) is connectable to the supporting structure (2), by means of the coupling (43), in as many predetermined positions, in which to support the gate (38) axially at different heights, and which correspond to respective operating positions of the gate (38) with respect to the window (16).
3. A valve assembly as claimed in Claim 1 or 2, wherein the coupling (43) comprises a plurality of seats (44), spaced axially apart from one another parallel to the axis (A), and at least one catch element (45) for selectively engaging the seats (44); the seats (44) and the catch element (45) being carried on the rod (42) and the supporting structure (2) respectively, or vice versa.
4. A valve assembly as claimed in Claim 3, wherein the rod (42) and the catch element (45) are connected and released by moving one with respect to the other radially or crosswise to the axis (A).
5. A valve assembly as claimed in Claim 3 or 4, wherein the coupling (43) comprises a plurality of seats (44) located at the top end (46) of the rod (42) and spaced apart axially from one another along the rod (42); each seat (44) being defined by two facing axial shoulders (47) defined by respective radial flanges located along the rod (42); and wherein the catch element (45) comprises a C-shaped fork (48) which projects laterally from a free end (24) of a guide (23) and is shaped so as to click onto the rod (42), inside a seat (44), between two shoulders (47).
6. A valve assembly as claimed in Claim 5, wherein the catch element (45) is shaped so as to engage each seat (44) between two shoulders (47) and to click onto the rod (42), so as to secure the rod (42) to the supporting structure (2) and support the gate (38) axially at different heights by means of the rod (42).
7. A valve assembly as claimed in one of the foregoing Claims, wherein the rod (42) is shaped so as to have a predetermined amount of transverse flexibility, i.e. to be flexible transversely, so the flexibility of the rod (42) allows the top end (46) of the rod (42) to move elastically to selectively engage and disengage the rod (42) with and from the coupling (43).
8. A valve assembly as claimed in one of the foregoing Claims, wherein the gate (38) slides in a direction substantially parallel to the axis (A).
9. A valve assembly as claimed in one of the foregoing Claims, wherein the window (16) is located close to a bottom wall (12) of the vessel (7), and is elongated in a direction parallel to the bottom wall (12).
10. A valve assembly as claimed in one of the foregoing Claims, wherein the gate (38) is located on an outer surface (39) of the lateral wall (15) and is shaped to slide on the surface (39) and is larger than the window (16).
11. A valve assembly as claimed in one of the foregoing Claims, wherein the gate (38) is housed and slides inside a guide slot (40) located on said outer surface (39) and having two opposite lateral shoulders (41) for guiding the vertical movement, parallel to the axis (A), of the gate (38).

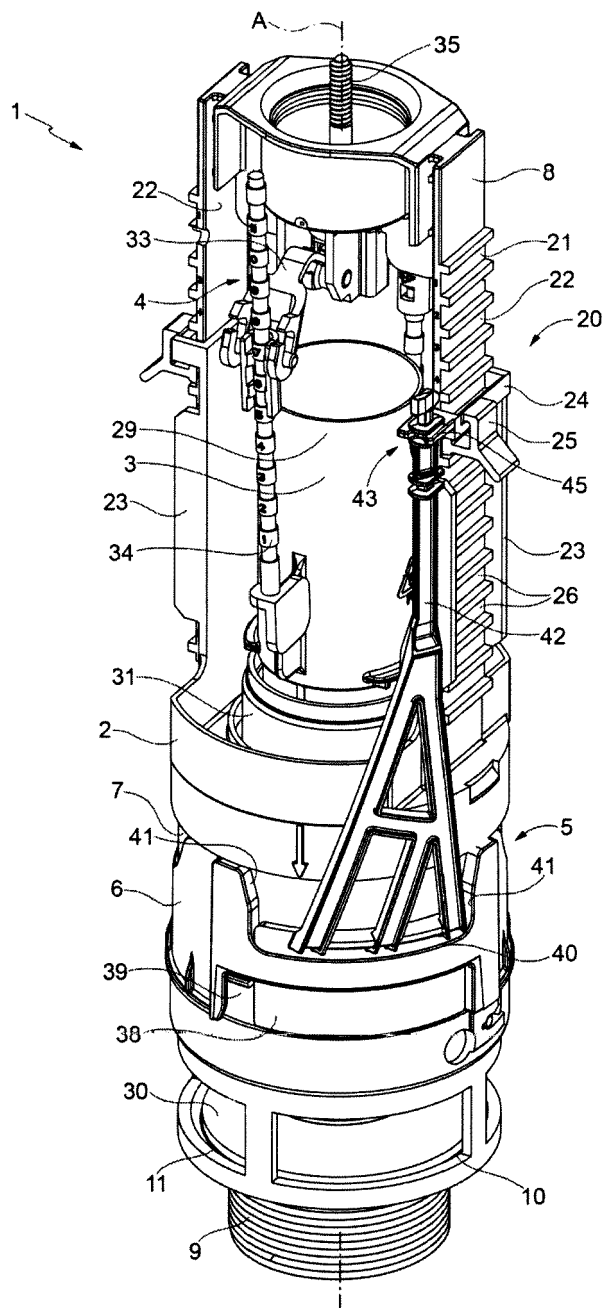


FIG. 1

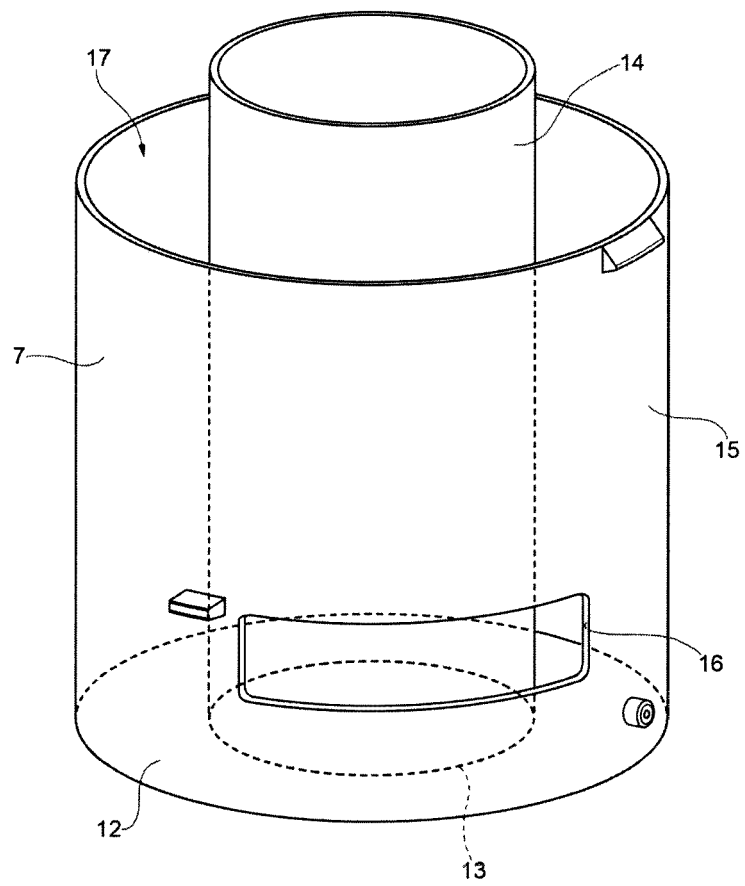


FIG. 2

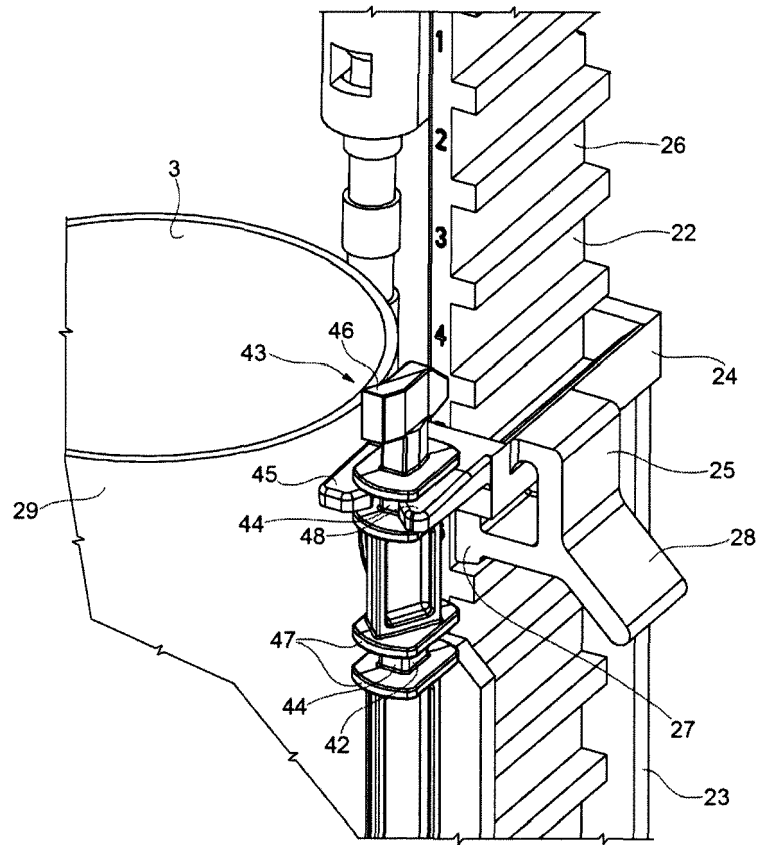


FIG. 3

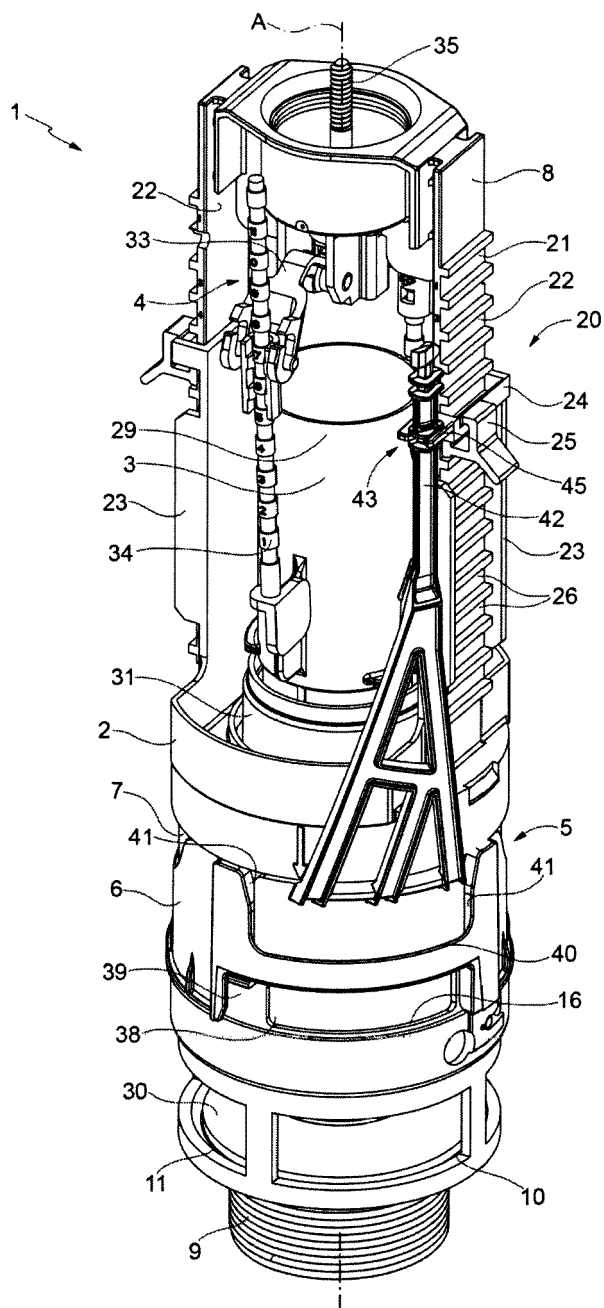


FIG. 4

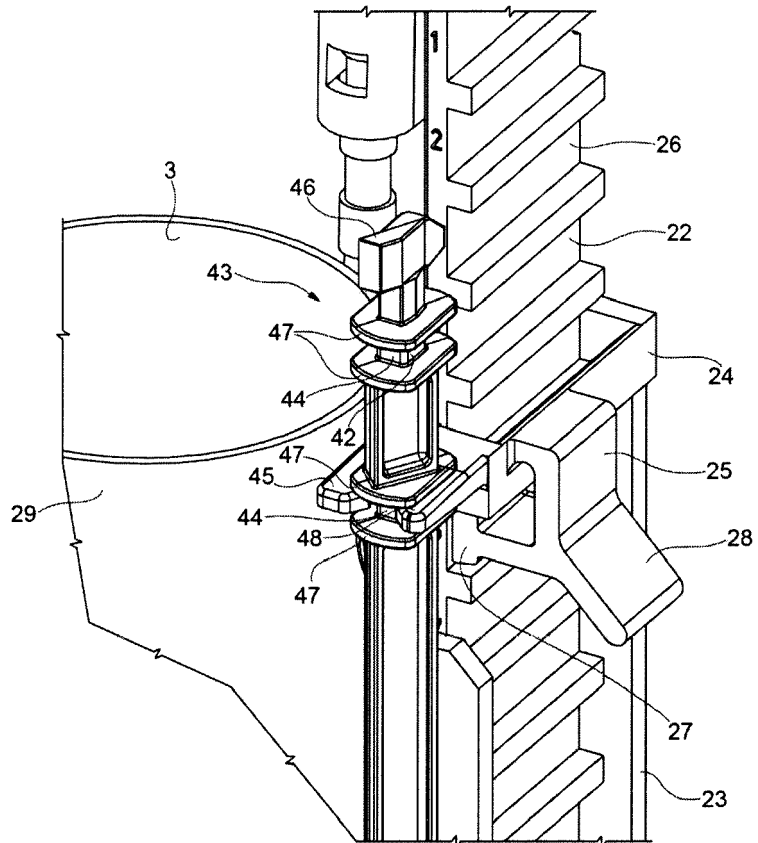


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 14 39 8003

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Place of search		Date of completion of the search	Examiner
The Hague		28 August 2014	De Coene, Petrus
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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