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(54) Water inlet-outlet assembly for a lavatory flush tank

(57) A water inlet-outlet assembly (2) for a lavatory flush tank (1), presenting a water inlet device (18) for feeding water into the tank (1) and connected to a water supply conduit (19); a water outlet device (16) fitted to the bottom wall (10) of the tank (1) and for feeding water to a discharge conduit (17); and a control device (20) for controlling the outlet device (16); at least the inlet device (18) being connected to the outlet device (16) by a supporting structure (53), and being aligned with the outlet device (16) along a substantially vertical axis (A).

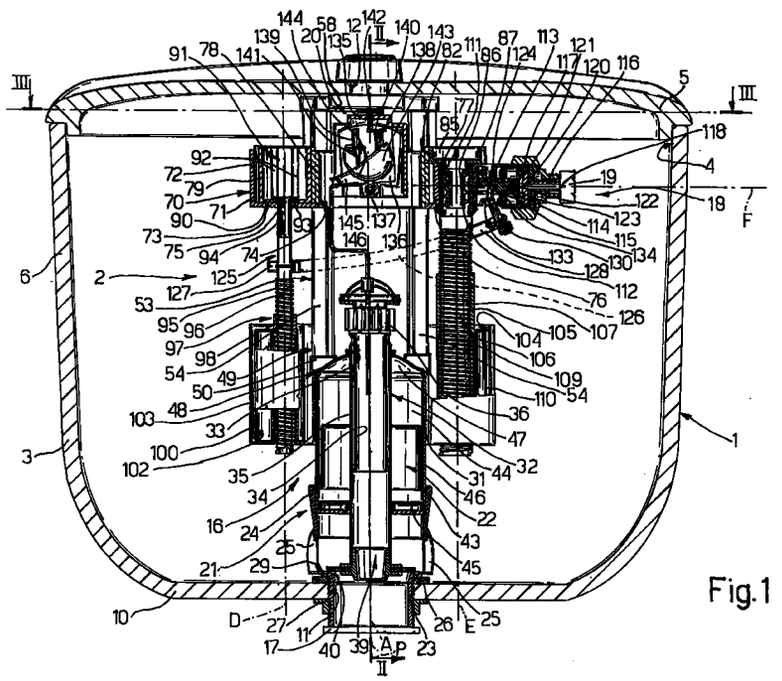


Fig.1

EP 0 761 892 A1

Description

The present invention relates to a water inlet-outlet assembly for a lavatory flush tank.

As is known, normally, lavatory flush tanks are substantially parallelepiped, are fitted to a fixed supporting body, and house a water inlet-outlet assembly.

Known inlet-outlet assemblies normally comprise a water inlet device connected to the water mains to feed water into the tank; an outlet device for discharging the water into a discharge conduit communicating with the lavatory; and a control device operated manually from the outside to control the outlet device and, hence also, the inlet device.

The inlet, outlet and control devices are normally separate assemblies located in different parts of the tank and each fitted to a respective portion of the tank either directly or by means of supporting brackets.

On account of the above arrangement, known assemblies, besides being relatively bulky, do not allow of any departure from the traditional shape of the flush tank to meet special design requirements, e.g. triangular-section or sharply downward-tapering tanks.

It is an object of the present invention to provide a straightforward, low-cost water inlet-outlet assembly for a lavatory flush tank, designed to overcome the above drawbacks, and which, in particular, is extremely compact and of small transverse size as compared with known assemblies.

According to the present invention, there is provided a water inlet-outlet assembly for a lavatory flush tank, the assembly comprising a water inlet device connected to a water supply conduit; a water outlet device for feeding water to a discharge conduit; and a control device for controlling said outlet device; characterized in that at least said inlet and outlet devices are substantially aligned along a single axis.

Preferably, the control device of the above assembly is also located substantially along said single axis.

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 section of a lavatory flush tank featuring a water inlet-outlet assembly in accordance with the teachings of the present invention;

Figure 2 shows a section along line II-II of the Figure 1 assembly;

Figure 3 shows a section, with parts removed for clarity, along line III-III in Figure 1;

Figure 4 shows a front section, with parts removed for clarity, of a first detail of the Figure 1 assembly;

Figure 5 shows a section along line V-V in Figure 4;

Figure 6 shows a larger-scale partially sectioned plan view of a second detail in Figure 1;

Figure 7 shows a section along line VII-VII in Figure 6;

Figure 8 shows a front view of a detail in Figure 6;

Figure 9 shows a plan view of the Figure 8 detail;

Figure 10 shows the same view as in Figure 1 to illustrate a variation of a detail in Figure 1.

Number 1 in Figures 1 to 3 indicates a lavatory flush tank housing a water inlet-outlet assembly 2.

Tank 1 comprises a hollow body 3 with a top opening 4 closed by a lid 5; and body 3 is defined by an annular lateral wall 6 with rounded corners and presenting a flat portion 8 which is positioned contacting a fixed body 9 for supporting tank 1, and by a substantially flat bottom wall 10 connected to lateral wall 6.

Wall 10 and lid 5 present respective through holes 11 and 12 coaxial with a common axis A perpendicular to wall 10; and hole 12 is engaged by the end portion of a pushbutton 15 for manually controlling assembly 2 from the outside.

As shown in Figures 1 and 2, assembly 2 comprises a water inlet device 18 for feeding water into tank 1 and connected to a water supply conduit 19; a water outlet device 16 fitted to wall 10 and for feeding water to a discharge conduit 17 connected to a lavatory (not shown); and a control device 20 operated manually from the outside to control device 18, and of which pushbutton 15 forms part.

As shown in Figures 1 and 2, devices 16, 18 and 20 are all aligned along axis A, and outlet device 16 comprises a drain 21 fitted to wall 10 and supporting a known valve 22 coaxial with axis A and controlled by device 20.

More specifically, drain 21 comprises an externally-threaded end nipple 23 extending through hole 11; a substantially cylindrical collar 24 coaxial with axis A; and a number of ribs 25 connecting nipple 23 to collar 24.

Nipple 23 is fitted to wall 10 in fluidtight manner by a seal 26 interposed between nipple 23 and wall 10, and by a ring nut 27 screwed on to the portion of nipple 23 projecting outwards of tank 1.

On the side facing collar 24, nipple 23 terminates with a flat inner supporting surface 29 perpendicular to axis A, and is fitted integral with the bottom ends of ribs 25, the top ends of which are connected integral with collar 24. By means of a known click-on connection 30, collar 24 is also fitted with the outer bell 31 of valve 22, which also comprises an overflow pipe 32.

Pipe 32 extends coaxially with axis A through an opening 33 formed in bell 31, and is connected to bell 31 so as to slide axially, under the control of device 20, between two limit positions (only one of which is shown in Figures 1 and 2).

More specifically, pipe 32 comprises a first inner tubular body 34 and a second outer tubular body 35 connected telescopically to each other and locked in relation to each other by a known ring nut 36 fitted to an end portion of body 35. Body 34 is connected to device 20, and, at the end facing drain 21, body 35 terminates with a known valve assembly 39 comprising a sealing ring 40, an outer annular portion of which contacts surface 29 to retain the water, in use, inside tank 1.

An intermediate portion of body 35 is fitted integral with a float 43, which is movable, in use, inside a chamber 44 defined by bell 31 and by an annular lid 45 integral with bell 31 and surrounding body 35.

As shown in Figures 1 and 2, bell 31 comprises a substantially cylindrical portion 46 coaxial with axis A; and a spherical bowl-shaped portion 47 fitted integral with the top end of portion 46 with which it defines an outer annular groove 48.

Devices 18 and 20 are fitted integrally to bell 31 by a supporting assembly 49 comprising a shaped ring 50 (Figures 6 and 7) fitted positively to portion 47 of bell 31, coaxially with axis A, and in turn comprising a number of inner projections 51 which snap into groove 48.

Ring 50 also comprises two tubular bodies 52 presenting a substantially trapezoidal cross section, and extending between ring 50 and flat portion 8 of wall 6 on either side of a vertical plane P through axis A and perpendicular to portion 8.

Assembly 49 also comprises a supporting element 53 (Figures 4 and 5) in turn comprising two C-section uprights 54 (Figure 6) parallel to each other and to axis A, and each loosely engaging a respective body 52. Uprights 54 are locked, in use, inside bodies 52 by means of an elastic retaining element 55 (Figures 8 and 9), which comprises an intermediate arc-shaped portion 56 adhering to the outer surface of ring 50, and two shaped end appendixes 57, each of which is forced inside the space between body 52 and respective upright 54 to lock uprights 54 in relation to bell 31.

As shown in Figures 4 and 5, element 53 also comprises an annular plate 58 fitted integrally to the top ends of uprights 54, substantially perpendicularly to axis A, and projecting from uprights 54 over pipe 32.

Plate 58 supports and surrounds an adjusting assembly 59, which, when assembling tank 1, provides for adjusting the position of device 20 in relation to axis A in two directions B, C perpendicular to each other and to axis A.

More specifically, assembly 59 comprises two guide-and-slide assemblies 60, 61; assembly 60 in turn comprises a guide 62 fitted to plate 58 and parallel to direction B, and a slide 63 traveling along guide 62 and fitted with a further guide 64 parallel to direction C; and guide 64 forms part of assembly 61, which also comprises a further slide connected to guide 64 and defined by a collar 65 coaxial with axis A.

Element 53 also comprises an elastically deformable tongue 66 extending parallel to uprights 54 from the free front end of plate 58, and forming part of a snap-on connecting assembly 67 for releasably connecting device 18 to element 53.

More specifically, assembly 67 comprises a number of first connecting teeth 68 on uprights 54, and a number of second connecting teeth 69 on tongue 66 and cooperating with teeth 68.

As shown in Figures 1 and 2, inlet device 18 comprises an elongated body 70 extending in a direction parallel to direction B, located over and separated from device 16, and intersecting axis A.

More specifically, body 70 comprises a hollow open-topped portion 71 in turn comprising a lateral wall 72, and a bottom wall 73, which presents a first opening 74 formed coaxially with axis A, and a second opening 75 formed adjacent to opening 74 and coaxial with a further axis D parallel to and transversely to the side of axis A.

Body 70 also comprises a tubular intermediate portion 76, which defines a cylindrical passage 77 coaxial with an axis E parallel to axes A and D, located on the opposite side of axis A to axis D, and coplanar with axes A and D.

Portion 71 houses a ring gear 78 coupled to wall 72 in axially-fixed manner so as to rotate about axis A; and a hollow gear 79 coupled to wall 72 in axially-fixed manner so as to rotate about axis D, and presenting external teeth 80 meshing with external teeth 81 of gear 78.

Gears 78 and 79 form part of a gear transmission 82, which also comprises a further gear 85 rotating about axis E and presenting a hub 86 extending loosely inside cylindrical passage 77 defined by portion 76, and an externally-toothed portion 87 projecting upwards and outwards of portion 76 and meshing with teeth 81 of gear 78.

Gear 79 presents a bottom wall 90 fitted integrally with a straight guide 91 extending inside gear 79 and parallel to axis D; guide 91 comprises two parallel axial grooves 92 facing each other and inside which slides a slide element 93 connected integrally to an end portion 94 of a hollow rod 95; rod 95 loosely engages opening 75, extends towards wall 10 coaxially with axis D, and presents an externally-threaded end portion 96 opposite portion 94; and portion 96 defines the screw of a screw-nut screw coupling 97, which also comprises a nut screw 98 connected to screw 96 and integrally to a hollow float 100.

Float 100 is defined by a shaped hollow body (Figure 3) presenting an opening 102 facing wall 10, and is housed loosely inside a tank 103 substantially complementary in shape to that of float 100 and presenting an opening 104 facing lid 5.

Float 100 is movable in relation to tank 103 and along axis A between a lowered position in which float 100 is housed entirely inside tank 103, and a raised position in which float 100 projects partly beyond the top edge of tank 103.

Tank 103 is fitted integrally with a nut screw 105 coaxial with axis E and forming part of a screw-nut screw assembly 106, which in turn comprises a screw 107 defined by an end portion of a pipe 109 for feeding water into tank 1.

Pipe 109 extends coaxially with axis E and through a tubular portion 110 fitted to float 100, and terminates with a cylindrical portion 111, which engages in rotary and axially-fixed manner the passage 77 defined by portion 76 of body 70.

Gear 85 is fitted in angularly-fixed manner to portion 111, and hub 86 extends inside portion 111,

presents an outside diameter approximately equal to but no larger than the inside diameter of portion 111, and presents a helical groove 112 on its outer periphery.

Via a number of radial passages (not shown) formed through portion 111, groove 112 communicates with the outlet of a conduit (not shown) formed in an end portion 113 of body 70.

The conduit formed in portion 113 presents an inlet communicating with a chamber 114, which is defined, on one side, by a hollow portion 115 of portion 113, and, on the other, by a nozzle 116 for feeding water into chamber 114 and connected in fluidtight manner to hollow portion 115 by a ring nut 117.

Nozzle 116 presents an inlet 118, which is connected to water supply conduit 19; and an outlet 120, which terminates inside chamber 114 and faces a plug element 121 for closing outlet 120.

Element 121 presents a head 122 made of elastomeric material and cooperating in contacting manner with outlet 120; and a shank 123, which, in sliding, angularly-fixed and fluidtight manner, engages a guide seat 124 extending coaxially with an axis F perpendicular to and in the same plane as axes A, D, C, and formed through portion 113 of body 70.

By means of a lever actuating device 125, element 121 is movable both ways along axis F between a forward closing position in which it closes outlet 120 of nozzle 116 to prevent the inflow of water into chamber 114, and a withdrawn idle position in which it permits water to flow from nozzle 116 and through chamber 114 to the conduit formed in portion 113.

Device 125 comprises a first fork lever 126, one end portion 127 of which is connected to an intermediate portion of rod 95, and is moved, together with rod 95 and along axis D, between a raised position corresponding to the closing position of element 121, and a lowered position corresponding to the opening position of element 121. Lever 126 also presents an end portion 128 opposite portion 127 and connected integral with an end portion of a further lever 130 forming with lever 126 a given angle of less than 180°.

Opposite the portion connected to lever 126, lever 130 presents an end portion hinged to portion 113 of body 70 by a hinge (not shown) so as to rotate about an axis perpendicular to axes A, D, E, F, and connected to shank 123 of element 121 by a teardrop-shaped cam 133, which is connected integral with and projects from lever 130, and cooperates in contacting manner with an axial shoulder 134 formed on shank 123.

As shown in Figures 1 and 3, control device 20 extends partly inside ring gear 78, is supported by plate 58 via guide-and-slide assemblies 60, 61, and, in addition to pushbutton 15, also comprises a frame 135 connected integrally in known manner to collar 65, and a plate 136 positioned vertically inside ring gear 78 and presenting a bottom portion connected to frame 135 by a hinge 137 presenting an axis perpendicular to the plane of axes A, D, E, F. Plate 136 swings about the axis of hinge 137 between a first limit angular position in which it is inclined towards gear 79, and a second limit angular position in which it is inclined towards gear 85.

Device 20 also comprises two straight, parallel, transversely-spaced guides 138, 139 connected integral with plate 136; and two slides 140, 141, which are T-shaped when viewed from the front, are movable along respective guides 138, 139, and cooperate selectively with a free end of a rod 142 extending through slide 65 and presenting an opposite end connected integrally with pushbutton 15. As they are moved, slides 140, 141 also cooperate selectively with respective portions of a semicircular plate 143, which is movable along a semicircular guide 144, formed on plate 136 between hinge 137 and guides 138, 139, so as to oscillate, in use, in relation to plate 136 and about an axis parallel to the axis of hinge 137. Plate 136 is connected integral with a lever arm 145 extending laterally towards gear 79 and to which is hinged the top end of a rod 146, the bottom end of which is connected in known manner to the top end of pipe 32. As such, arm 145, rod 146 and pipe 32 are movable by plate 143 between a lowered closed position in which seal 40 rests against surface 29, and a raised open position in which seal 40 is detached from surface 29.

Operation of assembly 2 will now be described as of the condition in which tank 1 is empty of water; tank 103 is located a given distance from wall 10 of tank 1; seal 40 rests against surface 29; and float 100 is lowered so that actuating device 125 maintains head 122 of element 121 in the withdrawn position.

As of the above condition, when water is supplied to inlet 118 of nozzle 116, it flows into chamber 114, along the conduit formed in portion 113 and through the openings in portion 111 into pipe 109, and from there into tank 1.

When the level of the water rises over the top end of tank 103, water flows into the space between tank 103 and float 100, which gradually rises to raise rod 95 and move element 93 along respective guide 91.

The upward movement of rod 95 also moves portion 127 of lever 126 gradually towards body 70, so that lever 130 rotates about the axis about which it is hinged to portion 113 of body 70; and cam 133 therefore exerts pressure on shoulder 134 to gradually move element 121 into the forward position in which it prevents the outflow of water from outlet 120 of nozzle 116.

At this point, when pushbutton 15 is pressed, pipe 32 is raised, seal 40 is detached from surface 29, and water flows out through nipple 23; and, as the water level falls inside tank 1, float 100 gradually moves back down, and device 125 moves element 121 back to the withdrawn position to allow the inflow of water into tank 1.

The water level inside tank 1, and hence the amount of water discharged, may be regulated by means of transmission 82. More specifically, the position of tank 103, and at the same time of float 100, along axis A is adjustable by means of gear 85. As regards the adjustment of float 100, the adjustment of gear 85 is

transmitted by ring gear 78 to gear 79 and via rod 95 to screw-nut screw coupling 97, which is so designed as to move float 100 in perfect synchronism with tank 103, so that, during adjustment, the position of float 100 in relation to tank 103 remains unchanged, and, after adjustment, assembly 2 is again in a position to operate as described above.

The Figure 10 Variation relates to an assembly 150 similar to assembly 2, and the component parts of which are indicated, where possible, using the same numbering system as for the corresponding parts of assembly 2.

Assembly 150 comprises a control device 151 again located along axis A, but which differs from device 20 by comprising a rod 152 extending coaxially with axis A, and presenting a bottom end portion 153 connected to overflow pipe 32, and a top end portion 154 connected integrally in known manner to a knob 155. More specifically, knob 155 presents a substantially cylindrical shank 156 coaxial with axis A and connected in axially-sliding manner to a guide element 157 fitted to slide 65 and connected to lid 5.

The particular arrangement, i.e. perfect alignment, of devices 16, 18, 20 and 151 along the same axis A therefore enables the formation of inlet-outlet assemblies 2, 150 which are extremely compact and of very small size transversely.

As such, assemblies 2 and 150 may be installed in flush tanks of any shape, and enable the use of new tank designs with small cross sections, and, in particular, of angular or sharply downward-tapering tanks.

Clearly, changes may be made to assemblies 2 and 150 as described and illustrated herein without, however, departing from the scope of the present invention. In particular, devices 16, 18, 20 and 151 may be formed differently from those described by way of example herein, providing they remain substantially aligned along axis A. More specifically, device 20 may be replaced by a pneumatic actuating device located along or adjacent to axis A. And even though, in the latter case, device 20 is no longer perfectly aligned with axis A, the inlet-outlet assembly is still compact and small enough transversely to be housed inside flush tanks of particular design as described above.

Devices 16, 18, 20 and 151 may also be connected to one another differently from the manner described. In particular, providing they are aligned along axis A, each of devices 16, 18, 20, 151 may be connected to a respective portion of tank 1.

Claims

1. A water inlet-outlet assembly (2, 150) for a lavatory flush tank (1), the assembly (2, 150) comprising a water inlet device (18) connected to a water supply conduit (19); a water outlet device (16) for feeding water into a discharge conduit (17); and a control device (20, 151) for controlling said outlet device (16); characterized in that at least said inlet and outlet devices (18, 16) are substantially aligned along a single axis (A).

2. An assembly as claimed in Claim 1, characterized in that said control device (20, 151) is also located substantially along said single axis (A).

3. An assembly as claimed in any one of the foregoing Claims, characterized by comprising a frame (53) for supporting at least said inlet device (18); and first connecting means (50, 55) for connecting said frame (53) to a fixed body (31).

4. An assembly as claimed in Claim 3, characterized in that at least part of said control device (20) is supported by said frame (53) along said axis (A); second connecting means (60, 61) being provided for connecting at least part of said control device (20) to said frame (53).

5. An assembly as claimed in Claim 3 or 4, characterized in that said first connecting means (50, 55) are adjustable connecting means for adjusting the position of said inlet device (18) in relation to said outlet device (16) at least along said axis (A).

6. An assembly as claimed in Claim 4, characterized in that said second connecting means (60, 61) are adjustable connecting means.

7. An assembly as claimed in Claim 6, characterized in that said second connecting means comprise a first and second guide-and-slide device (60, 61); said guide-and-slide devices (60, 61) respectively adjusting the position of at least part of said control device (20) in a first (A) and second (B) direction incident with each other and crosswise to said axis (A).

8. An assembly as claimed in any one of the foregoing Claims, characterized in that said control device (20) comprises pushbutton actuating means (15) located along said axis (A).

9. An assembly as claimed in any one of the foregoing Claims from 1 to 7, characterized in that said control device (151) comprises at least a rod (152) substantially coaxial with said axis (A) and movable in opposite directions parallel to said axis (A).

10. An assembly as claimed in any one of the foregoing Claims, characterized in that said axis (A) extends substantially parallel to the outflow direction of the water from said outlet device (16).

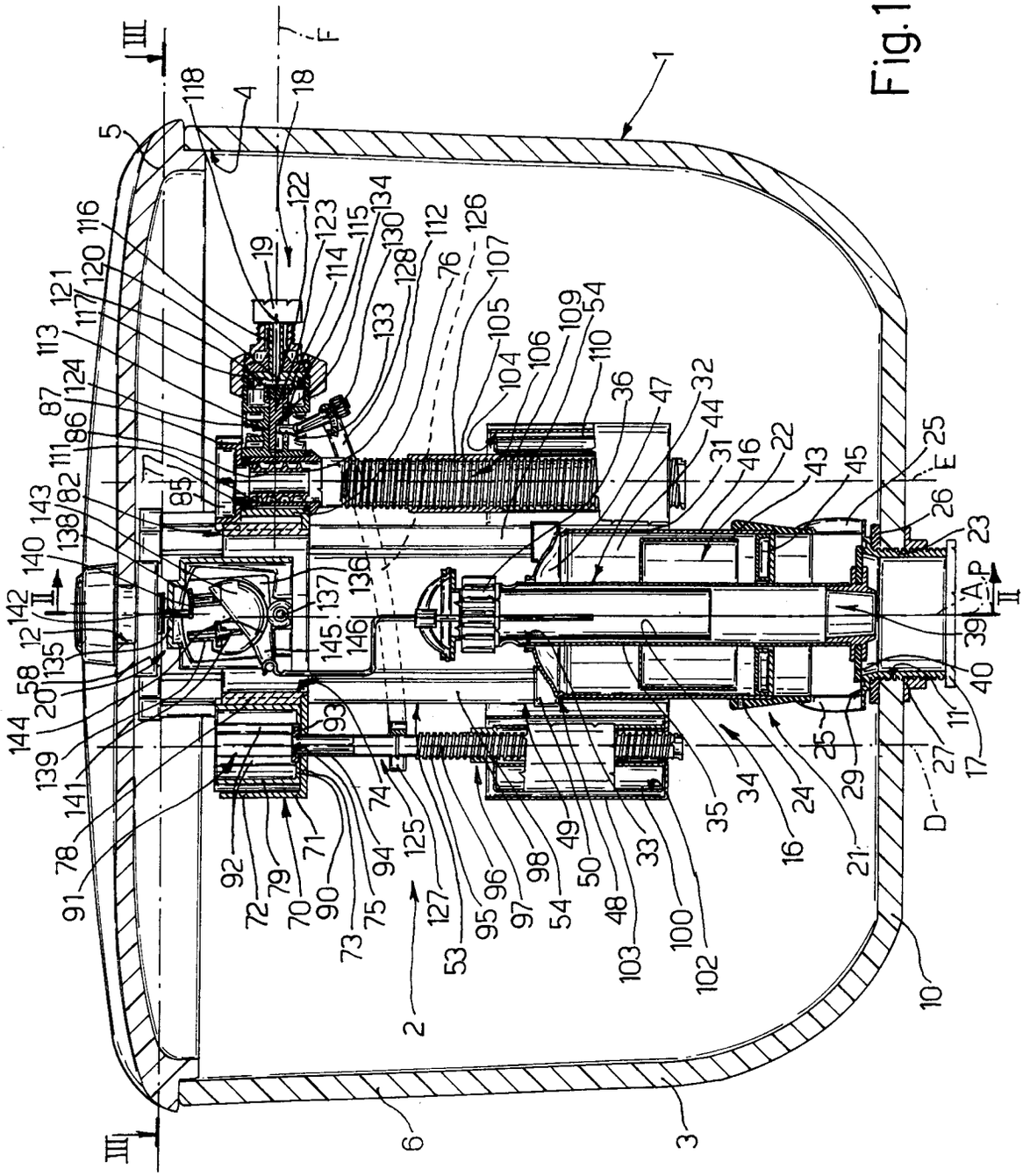
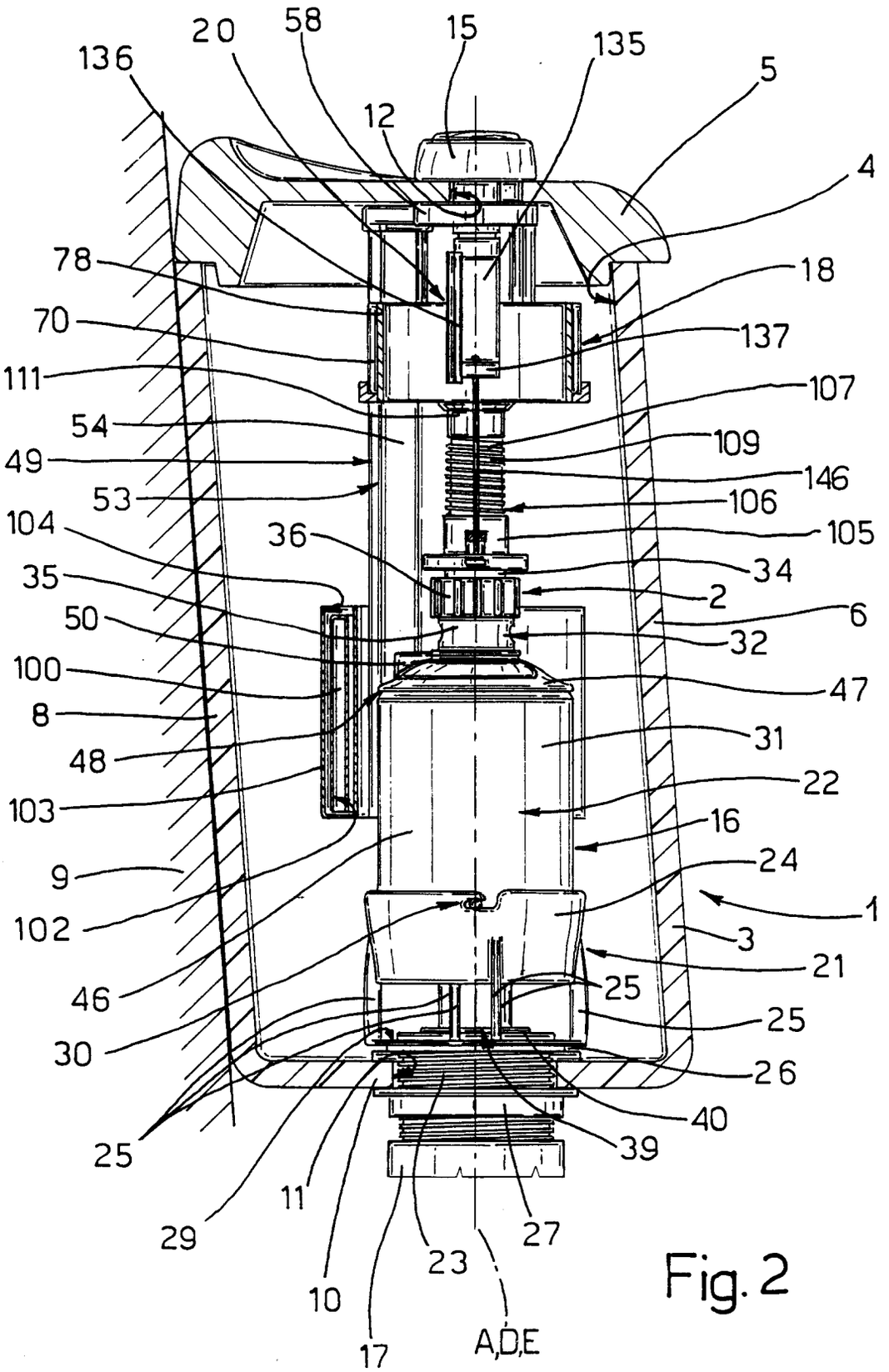


Fig.1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A,D,E

Fig. 2

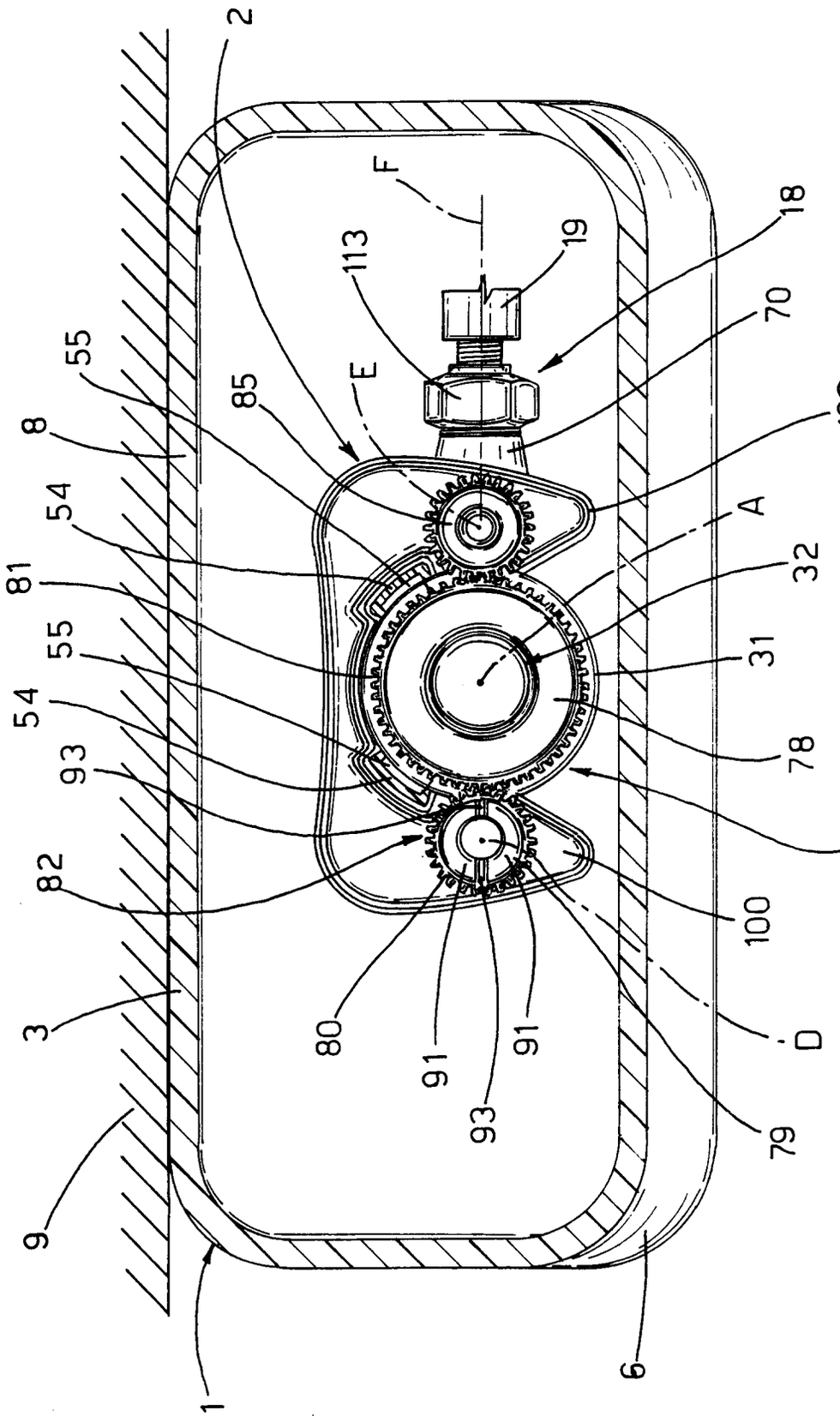
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Fig.3

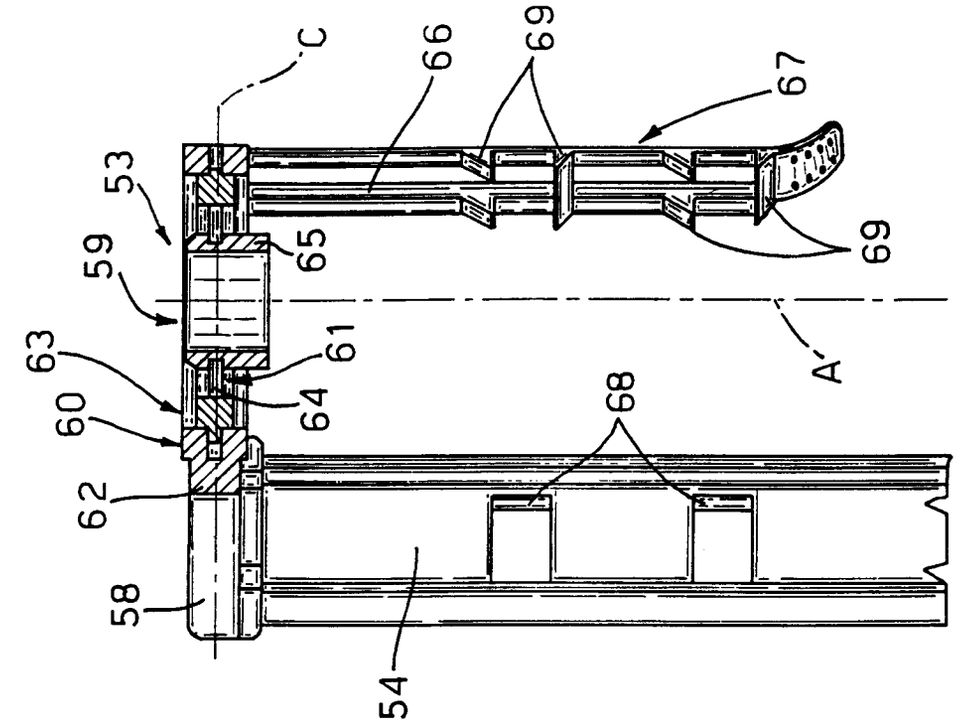
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Fig.5

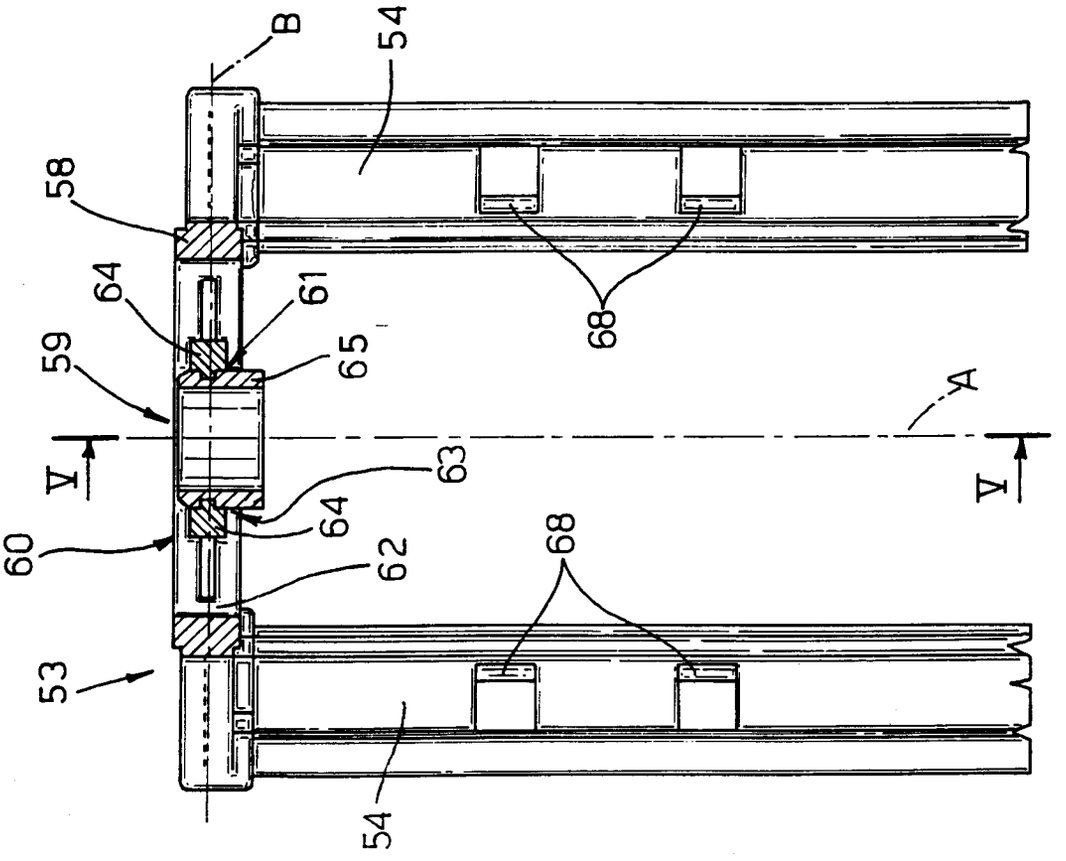
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Fig.4

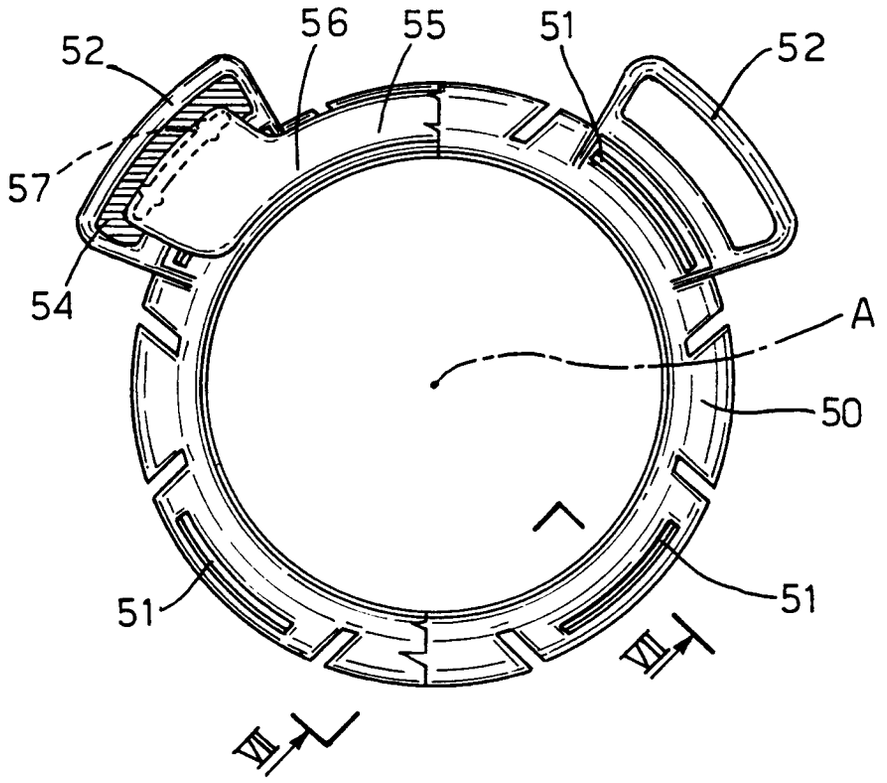

Fig.6

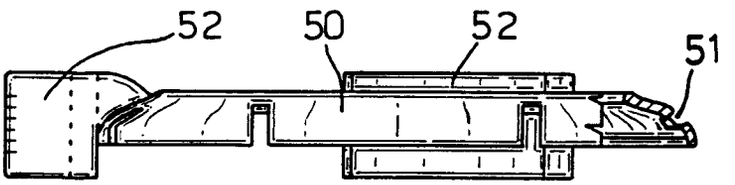

Fig.7

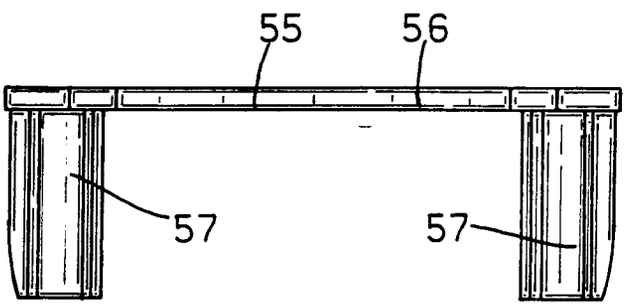

Fig.8

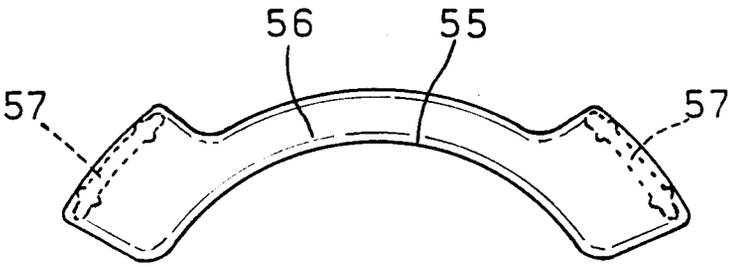

Fig.9

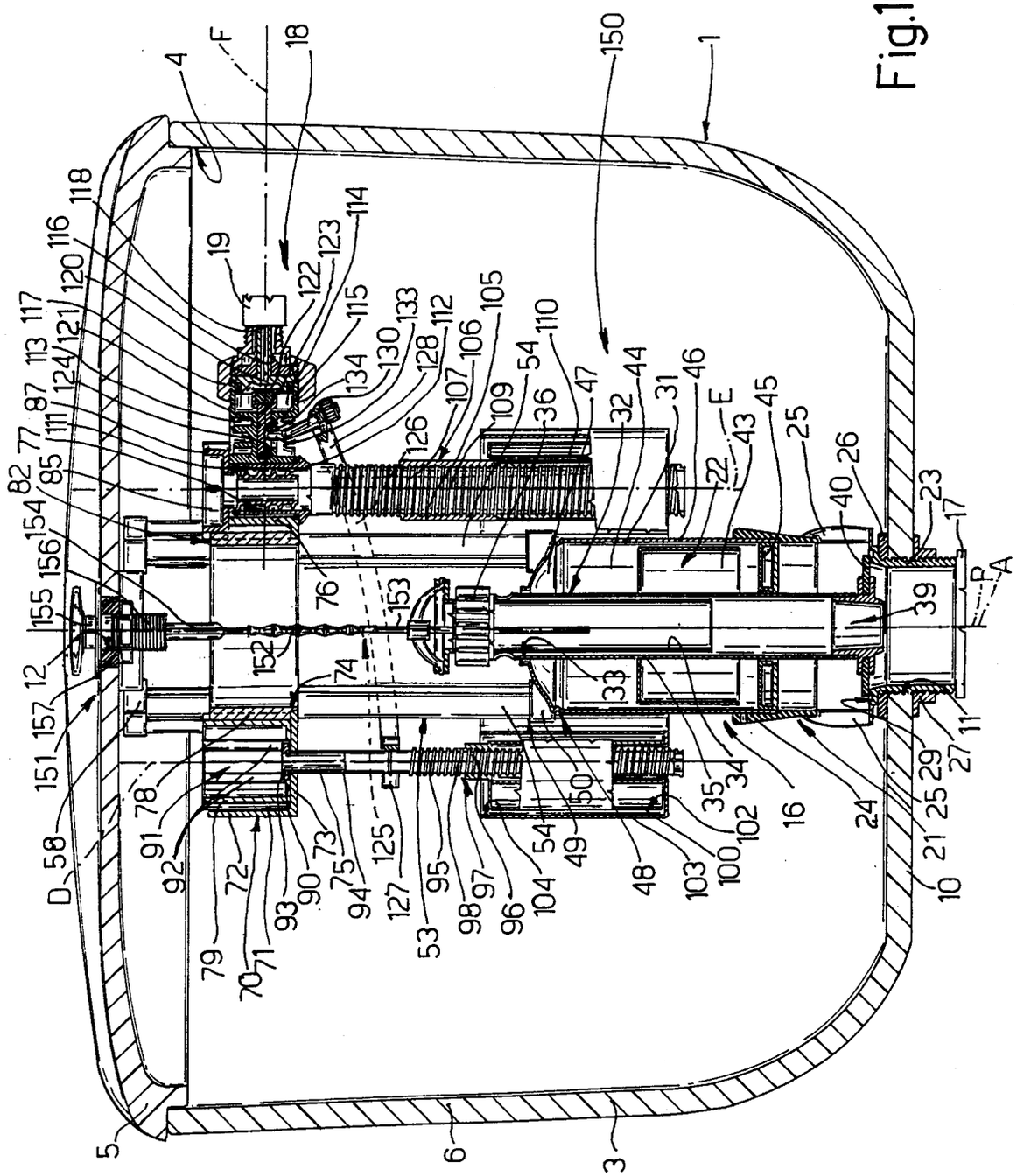

Fig.10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 11 2460

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	GB 2 245 910 A (IFO SANITAR AB) * abstract; figures * ---	1-4,8,10 5-7	E03D1/36
X A	FR 2 254 689 A (HYKON-PATENT AB) * the whole document * ---	1-4,10 8	
X	FR 2 675 172 A (D.P.M.P. SA) * abstract; claim 1 * ---	1,3	
X	FR 2 708 298 A (PIAT) * the whole document * ---	1,10	
A	EP 0 479 716 A (GEBERIT AG) * page 4, line 2 - line 5; figure 1 * ---	1-10	
A	EP 0 426 224 A (CECCHI) * abstract * -----	9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) E03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 November 1996	Van Beurden, J

CATEGORY OF CITED DOCUMENTS

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