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(11) **EP 0 761 893 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.03.1997 Bulletin 1997/11

(51) Int. Cl.⁶: **E03D 5/02**, E03D 1/14

(21) Application number: **96112459.1**

(22) Date of filing: **01.08.1996**

(84) Designated Contracting States:
AT CH DE FR GR IT LI LU NL PT

(30) Priority: **04.08.1995 IT TO950660**

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(54) **Pneumatic device for activating the discharge valve of a lavatory flush tank**

(57) A pneumatic device (8) presenting an outer casing (9); a connecting member (41, 51) movable in relation to the casing (9) and connectable positively to the movable member (7) of a discharge valve (5); a first (11) and second (12) pneumatic actuator associated with the casing and for moving the connecting member (41, 51) in opposite directions along a straight path (B); and two separate pneumatic pushbuttons (38) (39) for selectively and independently controlling the pneumatic actuators (11) (12) regardless of the position of the connecting member (41, 51) along the path (B); a connecting device (54) being provided to releasably connect the casing (9) to a fixed body (6) of the discharge valve (5).

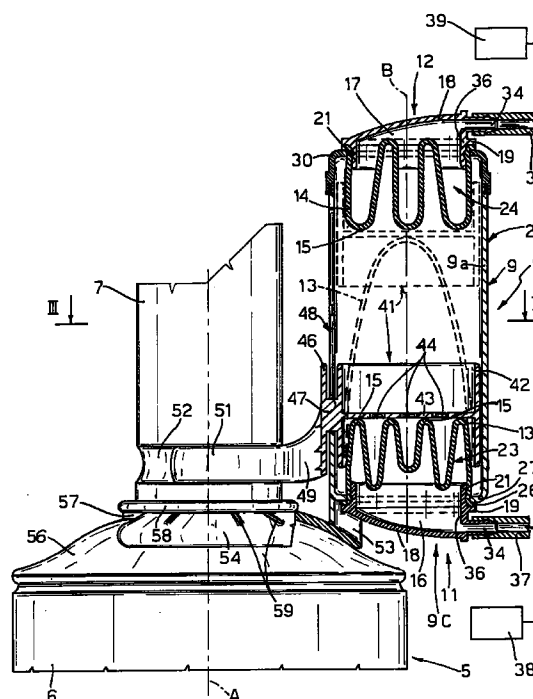


Fig. 1

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Description

The present invention relates to a pneumatic device for activating the discharge valve of a lavatory flush tank.

In the design of lavatory fixtures, increasing demand exists to locate the manually operated control governing the discharge valve of the flush tank in other than the usual positions and, in general, at some distance from the tank.

Yet a further demand, to reduce water consumption, is to be able to cut off the outflow at any time after the control is operated.

At present, pneumatic devices are known wherein two pneumatic actuators act in opposite directions on a movable actuating member connected integral with a movable member of the discharge valve. Such devices normally comprise a single pushbutton by which the two pneumatic actuators are operated alternately, to open and close the discharge valve, by means of an air distributor, which, in use, is switched to one or other of two operating positions by the movable member of the discharge valve.

Devices of the aforementioned type present several drawbacks. In particular, the distributor must of necessity be located in the waterfree part of the tank to prevent the water from entering the conduits connecting the distributor to the pushbutton and the two pneumatic actuators.

Moreover, switching of the air supply by the distributor cannot be effected until the movable member of the valve comes to the end of its travel, i.e. reaches one or other of its limit positions, which means a time interval exists in which the outflow of water cannot be cut off.

Finally, such devices are complicated to assemble, require frequent servicing, are difficult to adapt to existing tanks, and are relatively expensive to produce.

It is an object of the present invention to provide a straightforward, reliable pneumatic device designed to overcome the aforementioned drawbacks typically associated with known devices.

According to the present invention, there is provided a pneumatic device for activating a discharge valve of a lavatory flush tank, the device comprising a connecting member movable along a given path and connected integral with a movable member of said valve; and a first and second pneumatic actuator, which act on said connecting member to move the connecting member in opposite directions along said path; characterized by comprising separate first and second control means for selectively and independently controlling said pneumatic actuators regardless of the position of the connecting member along said path.

Preferably, the above device comprises an outer casing, and said connecting member comprises a slide portion housed inside the casing, and guide means associated with the casing; said slide portion being connected to said guide means so as to slide along said path.

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 partial side view of a lavatory flush tank discharge valve, and a section of a preferred non-limiting embodiment of a pneumatic device in accordance with the teachings of the present invention;

Figure 2 shows a larger-scale detail of the Figure 1 device;

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

Number 5 in Figure 1 indicates a discharge valve for a lavatory flush tank (not shown). Valve 5 is fitted to the bottom wall (not shown) of the tank, and comprises a fixed body 6, and an overflow tube 7 fitted to fixed body 6 in sliding manner along an axis A coincident with the axis of tube 7 itself.

Tube 7 is moved both ways along axis A by a pneumatic device 8, which comprises a hollow elongated casing 9 presenting an axis B parallel to axis A, and two pneumatic actuators 11 and 12.

Each actuator 11, 12 comprises a deformable membrane 13, 14 made of elastomeric material, and which is bag-shaped when deformed - as shown by the dotted line for membrane 13 in Figure 1 - and forms a number of bends 15 when idle - as shown by the continuous lines in Figure 1.

Actuators 11 and 12 also comprise respective identical plugging members 16 and 17, each of which forms a respective end portion of casing 9, and positively engages an intermediate cylindrical portion 9a of casing 9 extending coaxially with axis B. Each member 16, 17 grips a peripheral end portion of respective membrane 13, 14 against a respective end portion of portion 9a, and presents a curved asymmetrical projection 18, a flat flange 19 and a cylindrical portion 21.

Portion 21 presents an outer annular groove 22 (Figure 2) for airtight connection of respective membrane 13, 14 to portion 9a, so that a respective variable-volume chamber 23, 24 is formed between each membrane 13, 14 and respective member 16, 17.

More specifically, member 16 is positioned so that flange 19 grips a circular edge 26 of membrane 13 against an end edge 27 of portion 9a, which edge 27 is bent inwards to define an inner projection of portion 9a, and is located at annular groove 22 of member 16 so that membrane 13 is also gripped in airtight manner between edge 27 and groove 22.

As shown in Figure 1, portion 9a comprises a cylindrical tubular body 29 coaxial with axis B, and terminates, at the end facing member 17, with a collar 30, which is connected integral with body 29 and presents an edge 32 similar in shape to edge 26 and bent inwards to define a respective inner projection.

As shown in Figure 2, flange 19 of member 17 grips a circular edge 33 of membrane 14 against bent edge

32, which is located at annular groove 22 of member 17 so that membrane 14 is also gripped in airtight manner between edge 32 and groove 22.

Each member 16, 17 also presents an outward-facing air nozzle 34 located at side 36 of curved projection 18; and each nozzle 34 is connected to a respective known pneumatic pushbutton 38, 39 (shown schematically in Figure 1) by a respective flexible conduit 37. More specifically, pneumatic pushbuttons 38, 39 may be of any type, e.g. comprising a variable-volume air chamber defined, for example, by a bellows, and a known device for varying the volume of the air chamber.

Control device 8 also comprises a movable connecting member in turn comprising a slide 41 connected to portion 9a so as to slide along axis B. More specifically, slide 41 comprises a cylindrical wall 42 inside portion 9a, and a flat partition 43 connected integral with wall 42, extending inside wall 42, crosswise to axis B, between membranes 13 and 14, and which, in use, is moved both ways along axis B by membranes 13 and 14. Partition 43 presents three openings 44 to enable slide 41, in use, to move freely along axis B in the presence of any fluid inside casing 9.

Slide 41 also comprises a cylindrical sector-shaped outer wall 46 coaxial with wall 42 and connected to wall 42 by a guide block 47, which is partly housed inside an axial slot 48 formed in portion 9a, parallel to axis B, and extending just short of collar 30, so that slide 41 is connected to portion 9a in axially-sliding, angular-fixed manner.

A radial arm 49 extends from wall 46 and terminates with a fork 51, which snaps inside an annular groove 52 formed on the outer surface of overflow tube 7, and presents elastic arms (Figure 3) extending about an arc of over 180° and which snap inside groove 52 to connect slide 41 to the movable part of discharge valve 5 of the flush tank.

Casing 9 also comprises two bottom arms 53 fitted with a substantially conical open collar 54, which engages an outer annular seat 57 formed on fixed body 6 of valve 5, between a wall 56 and an end flange 58. More specifically, collar 54 presents an inside diameter equal to that of seat 57, extends about an arc of over 180°, and presents radial slots 59 enabling it to expand elastically to snap inside seat 57.

To fit device 8 to discharge valve 5, flexible conduits 37 of the required length are connected to respective nozzles 34; collar 54 is snapped inside seat 57 on wall 56 to connect casing 9 to fixed body 6 of discharge valve 5; fork 51 of slide 41 is snapped inside groove 52 on tube 7; and flexible conduits 37 are connected to respective pushbuttons 38, 39, which may be located to suit the user.

Operation of device 8 will now be described as of the condition shown in Figure 1, wherein slide 41 is located adjacent to member 16 so that valve 5 is closed.

When pneumatic pushbutton 38 is operated as of the above condition, air is supplied along respective conduit 37 into variable-volume chamber 23 to distend

membrane 13 as shown by the dotted line in Figure 1. As it distends, membrane 13 cooperates directly with partition 43 to move slide 41 gradually upwards into the position shown by the dotted line; and, as it moves upwards, slide 41, via fork 51, draws overflow tube 7 upwards along axis A so that water flows out of the flush tank into the lavatory (not shown).

At any time after releasing pushbutton 38, and regardless of the position of slide 41 along axis B, pneumatic pushbutton 39 may be operated to feed air along respective conduit 37 into variable-volume chamber 24 and so distend membrane 14. Membrane 14 thus engages partition 43 from the top to move slide 41 gradually towards member 16; and fork 51 moves tube 7 back downwards to gradually close valve 5 and so cut off the outflow of water.

Holes 44 in partition 43 of slide 41 obviously permit the fluid inside casing 9 to pass freely from one side to the other of partition 43 to prevent any impediment or delay in the movement of slide 41.

The advantages of pneumatic device 8 as compared with known devices will be clear from the foregoing description.

In particular, device 8 operates both in the water-free portion of the tank, i.e. in air, as well as in the portion of the tank normally filled with water, i.e. immersed in water. In the latter case, each time the tank is emptied completely, at least part of the water in casing 9 flows out through slot 48, and flows back in when further water is fed into the tank.

Moreover, pushbuttons 38 and 39 may be located to suit the user, even some distance from the tank and not necessarily close to each other.

Pushbuttons 38, 39 and the particular arrangement of actuators 11, 12 in relation to slide 41 enable valve 5 to be opened or closed immediately in any intermediate operating condition, i.e. regardless of the position of slide 41 along axis B, thus greatly reducing water consumption.

Finally, device 8 may be fitted not only to tanks designed for the purpose but also to existing tanks by simply connecting casing 9 to the fixed body of the discharge valve and fork 51 to the overflow tube.

Clearly, changes may be made to device 8 as described and illustrated herein without, however, departing from the scope of the present invention.

For example, casing 9 may be formed differently from that described; and groove 52 may be formed further up tube 7, e.g. close to the top end of tube 7, so that device 8 operates in the waterfree portion of the tank.

Moreover, casing 9 may be fitted to any fixed part of the tank, as opposed to valve 5; and membranes 13, 14 may be formed differently from those described by way of example, and may be fitted to casing 9 other than as shown.

Claims

1. A pneumatic device (8) for activating a discharge

valve (5) of a lavatory flush tank, the device (8) comprising a connecting member (41, 51) movable along a given path (B) and connected integral with a movable member (7) of said valve (5); and a first (11) and second (12) pneumatic actuator, which act on said connecting member (41, 51) to move the connecting member (41, 51) in opposite directions along said path (B); characterized by comprising separate first (38) and second (39) control means for selectively and independently controlling said pneumatic actuators (11) (12) regardless of the position of the connecting member (41, 51) along said path (B).

2. A device as claimed in Claim 1, characterized by comprising an outer casing (9); and in that said connecting member (41, 51) comprises a slide portion (41) housed inside the casing (9), and guide means (48) associated with the casing (9); said slide portion (41) being connected to said guide means (48) so as to slide along said path (B).
3. A device as claimed in Claim 2, characterized in that said pneumatic actuators (11) (12) comprise respective variable-volume chambers (23) (24), each communicating with one of said first and second control means (38) (39); each variable-volume chamber (23) (24) being defined by a respective end portion (16) (17) of said casing (9) and by a respective elastically deformable membrane (13) (14).
4. A device as claimed in Claim 3, characterized in that said membranes (13) (14) cooperate directly in contact with said connecting member (41, 51).
5. A device as claimed in Claim 3 or 4, characterized in that each of said membranes (13) (14) is folded to form a number of bends.
6. A device as claimed in one of the foregoing Claims from 3 to 5, characterized in that said casing (9) comprises a cylindrical intermediate portion (9a); and in that each said membrane (13) (14) presents a respective peripheral portion gripped between said intermediate portion (9a) and a respective said end portion (16) (17).
7. A device as claimed in Claim 6, characterized in that each of said end portions (16) (17) of said casing (9) comprises a cylindrical portion (21) presenting an outer annular groove (22); each membrane (13) (14) being forced into a respective said outer annular groove (22) by a respective inner annular projection (27) (32) on said intermediate portion (9a).
8. A device as claimed in Claim 6 or 7, characterized in that each of said end portions (16) (17) of said

casing (9) presents an outer annular flange (19); and each of said membranes (13) (14) presents a peripheral portion (26) (33) gripped between a respective said flange (19) and a shoulder (27) (32) on said intermediate portion (9a).

9. A device as claimed in Claim 7, characterized in that said intermediate portion comprises two tubular bodies (30) (29) connected integral with each other; each of said inner annular projections (27) (32) being carried on a respective said tubular body (30) (29).
10. A device as claimed in one of the foregoing Claims from 2 to 9, characterized in that said slide portion (41) comprises a cylindrical wall (42) connected to said guide means (48); and a transverse partition (43) integral with said cylindrical wall (42) and extending crosswise to said path (B).
11. A device as claimed in Claim 9 or 10, characterized in that said guide means comprise a slot (48) formed in said outer casing (9) and parallel to said path (B); said slide portion (41) comprising a sliding portion (47) engaging said slot (48) in sliding manner.
12. A device as claimed in Claim 11, characterized in that said connecting member (41, 51) comprises connecting means (51) which snap on to said movable member (7) of the discharge valve (5).
13. A device as claimed in Claim 12, characterized in that said connecting means comprise a fork (51) connected integral with said sliding portion (47) and which snaps inside an annular groove (52) formed on said movable member (7) of the discharge valve (5).
14. A device as claimed in one of the foregoing Claims from 2 to 13, characterized by comprising further connecting means (54) for releasably connecting said casing (9) to a fixed supporting body (6).
15. A device as claimed in Claim 14, characterized in that said further connecting means (54) are snap-on connecting means.
16. A device as claimed in Claim 15, characterized in that said snap-on connecting means (54) comprise an elastic fork, which positively engages a seat (57) formed on a fixed body (6) of said discharge valve (5).

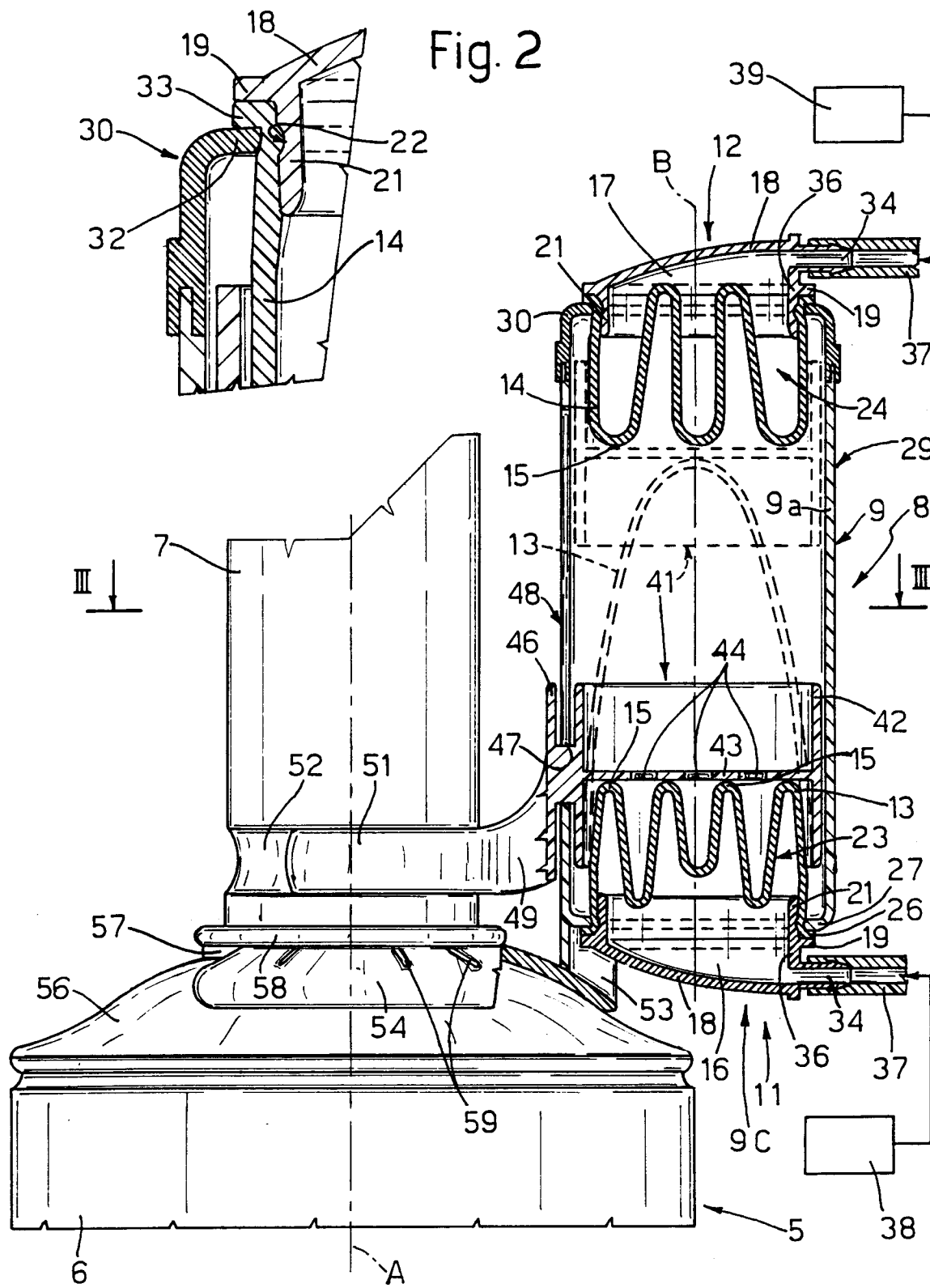
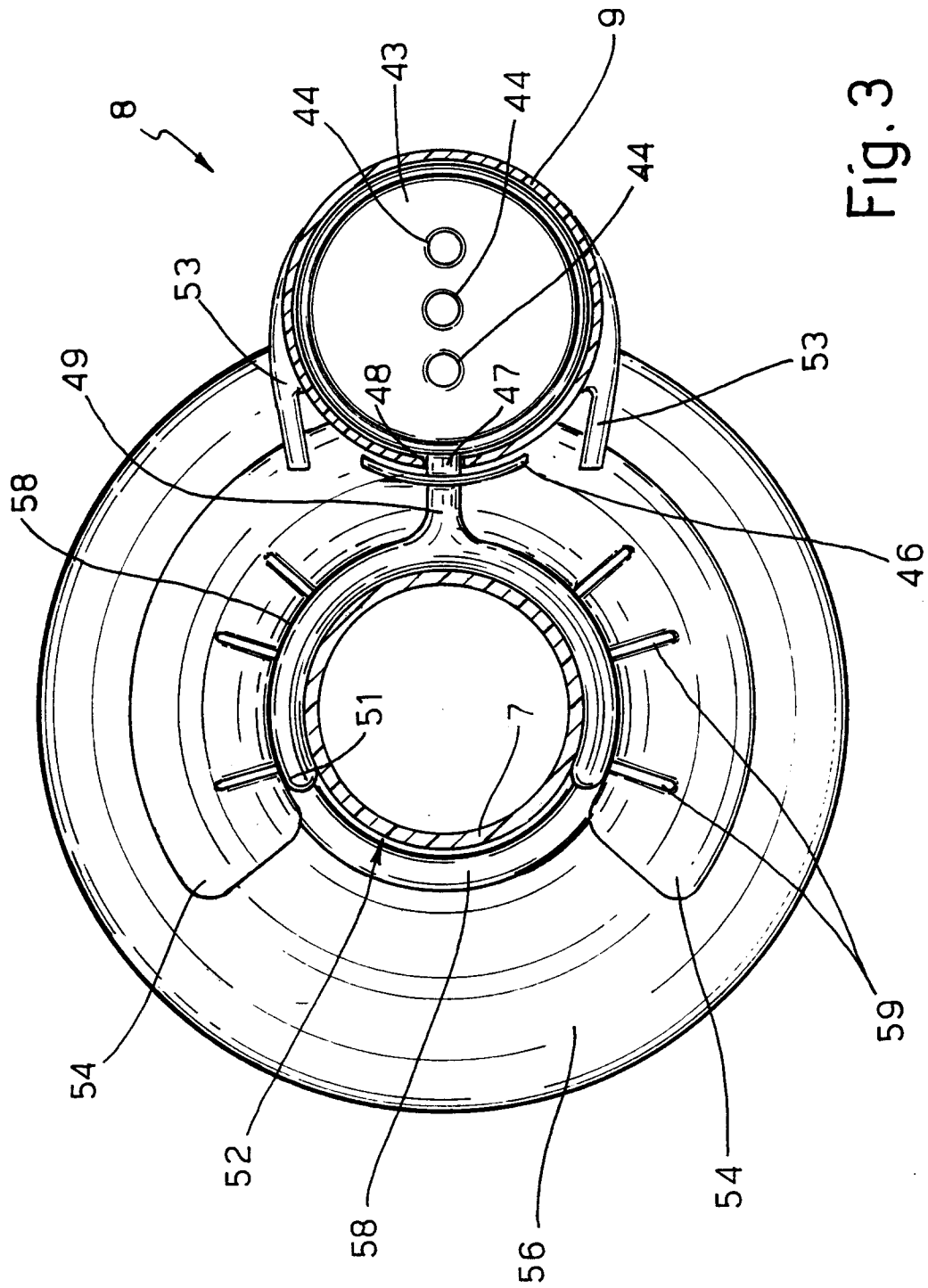


Fig. 1





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EUROPEAN SEARCH REPORT

Application Number
EP 96 11 2459

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)
A	DE 37 29 569 A (SCHWAB SANITÄR-PLASTIC GMBH) * the whole document *	1-6, 10, 12	E03D5/02 E03D1/14
A	GB 2 137 248 A (WISA BV) * page 1, line 126 - page 2, line 13 *	1	
A	US 4 809 367 A (SCOTT) * figure 1 *	1	
			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
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