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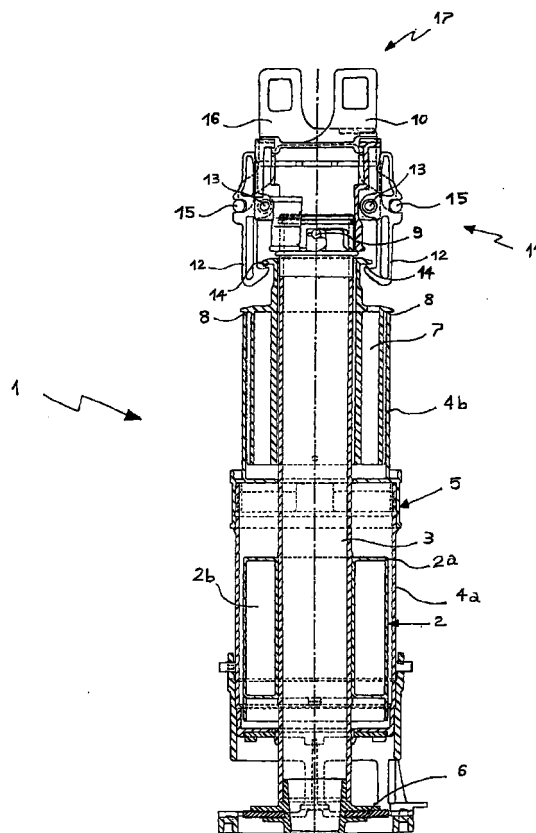
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(54) **Float for flush valves, and modular-valve system featuring such a float**

(57) A float (2) for flush valves, defined by a hollow body (2a) made of synthetic plastic material and defining internally a sealed buoyancy chamber (2b). The float (2) is made in one seamless, rigid piece, and, in combination, the sealed buoyancy chamber has an inside pressure lower than atmospheric pressure.



EP 0 995 846 A1

Description

[0001] The present invention relates to a float for flush valves for use in lavatory flush tanks; and to a modular-valve system featuring such a float.

[0002] Floats currently used for flush valves are defined either by solid bodies made of material with a specific weight lighter than water, or by hollow bodies defining a sealed inner chamber of given volume and containing air to define a buoyancy chamber.

[0003] The first type are made of synthetic foam material, such as polystyrene, and the second normally of plastic.

[0004] A major drawback of floats made of solid material lighter than water lies in buoyancy being strictly dependent on and normally small with respect to the volume, and hence external size, of the float. As a result, such floats are invariably bulky and, being normally made of soft, friable material (such as polystyrene), are easily damaged both during assembly and in actual use.

[0005] Hollow floats, on the other hand, to be pressed, must normally comprise two parts or half-shells joined end to end about the edges, which poses serious problems in the manufacture of this type of float. A mechanical joint, even made using sophisticated techniques from gluing to hot-blade or ultrasonic welding, fails to ensure against water eventually seeping inside the float, thus resulting not only in the float eventually becoming unserviceable, but also, in the meantime, in a variation in the force and speed with which the float closes the valve. Moreover, assembly and sealing of such floats involve considerable cost.

[0006] It is an object of the present invention to provide a float which, besides eliminating the aforementioned drawbacks typically associated with the known state of the art, is so designed as to combine a small volume with a high degree of buoyancy. The need for a float combining these two characteristics arises from increasing demand from lavatory flush tank manufacturers for modular flush valves, which, with only a few minor component alterations, can be fitted to tanks of different volumes, and provide for varying amounts of discharge.

[0007] As such, the float, which is undoubtedly one of the most important valve components, must be small enough to fit inside small tanks, while at the same time being buoyant enough to also be used effectively in larger tanks designed for large discharge volumes.

[0008] According to the present invention, there is provided a float for flush valves, comprising a hollow body made of synthetic plastic material and defining internally a sealed buoyancy chamber; characterized in that said body is made in one seamless, rigid piece; in combination, said sealed buoyancy chamber having an inside pressure lower than atmospheric pressure.

[0009] The float according to the present invention is also toroidal in shape so as to fit in sliding manner

along a central tube of a flush valve supporting the shutter member.

[0010] The resulting float is therefore hollow, while at the same time being formed in one piece, thus safeguarding against water seeping between the joints and so impairing the buoyancy and efficiency of the float. Moreover, no high-cost techniques are required to obtain a perfectly sealed joint, and the float also has the great advantage of combining compactness with a high degree of buoyancy.

[0011] The invention also relates to a modular-valve system for lavatory flush tanks, comprising a first number of elements of fixed size, and a second number of elements connectable to the first to form a valve suitable for a given tank; said first number of elements comprising a float as described above.

[0012] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawing showing a schematic longitudinal section of a flush valve in accordance with the present invention.

[0013] Number 1 in the accompanying drawing indicates a flush valve for a known lavatory flush tank (not shown for the sake of simplicity), and which provides, on command, for opening and closing a drain outlet on the tank by means of a shutter member 6 carried integrally by a tube 3 housed in sliding manner inside a supporting structure 4 defined by two elements 4a and 4b fitted one inside the other at a region 5. Central tube 3 is fitted with a float 2, and valve 1 comprises an actuating device 17 for controlling partial or total discharge.

[0014] Float 2 is defined by a hollow body 2a made of synthetic plastic material and defining internally a sealed buoyancy chamber 2b, and, according to the invention, is so made that body 2a is formed in one seamless, rigid piece, and, in combination, the pressure inside sealed chamber 2b is lower than atmospheric pressure.

[0015] This is achieved by means of a special injection molding technique wherein float 2 is made from plastic material injected in the fluid state inside a mold in which a vacuum is subsequently formed, while the plastic material is still in the fluid state, so as to form a hollow, one-piece molding.

[0016] More specifically, the mold is designed to form a toroidal float 2 fittable to central tube 3 of valve 1.

[0017] A weight 7 about central tube 3 is free to move axially, and rests on an edge 8 of supporting structure 4; the top end of central tube 3 is connected by pins 9 to a head 11, which terminates with an eyelet 10 defining a seat for a first control lever; head 11 supports hooks 12 rotating about respective pins 13; and, in the position shown, hooks 12 engage weight 7 beneath a collar 14, and are rotated outwards about pins 13 to release weight 7 by the upward movement of further respective pins 15 integral with a second eyelet 16 defining a seat for a second control lever.

[0018] Actuating device 17, which comprises both

eyelets 10 and 16, provides for partial or total discharge.

[0019] In actual use, the first lever in eyelet 10 raises central tube 3 to open the drain outlet and raise head 11 together with hooks 12, which in turn raise weight 7 by the underside of collar 14. When the control lever is released, shutter 6, together with tube 3, moves down to close the drain outlet, and, given the greater weight exerted on the shutter (due to weight 7), drops down rapidly to discharge only part of the water in the flush tank. Conversely, total discharge is effected using the second lever in eyelet 16, which raises pins 15 to release weight 7, which remains resting on supporting structure 4.

[0020] Shutter 6, together with tube 3, is therefore lighter, and, when the second lever is released, moves down more slowly and in opposition to the thrust exerted by float 2, to discharge all the water in the tank.

[0021] The valve described may form part of a flush valve system, for lavatory flush tanks, comprising a first number of elements of fixed size, and a second number of elements connectable to the first to form a valve suitable for a given tank. The first number of elements definitely comprises float 2 as described above, and, for example, shutter 6. And the second number of elements comprises, for example, tube 3, which must be of a length in proportion to the size of the tank; weight 7, which, given its function, must also conform with the size and water capacity of the tank; and definitely the part defining supporting structure 4, which must adapt to the size of the tank.

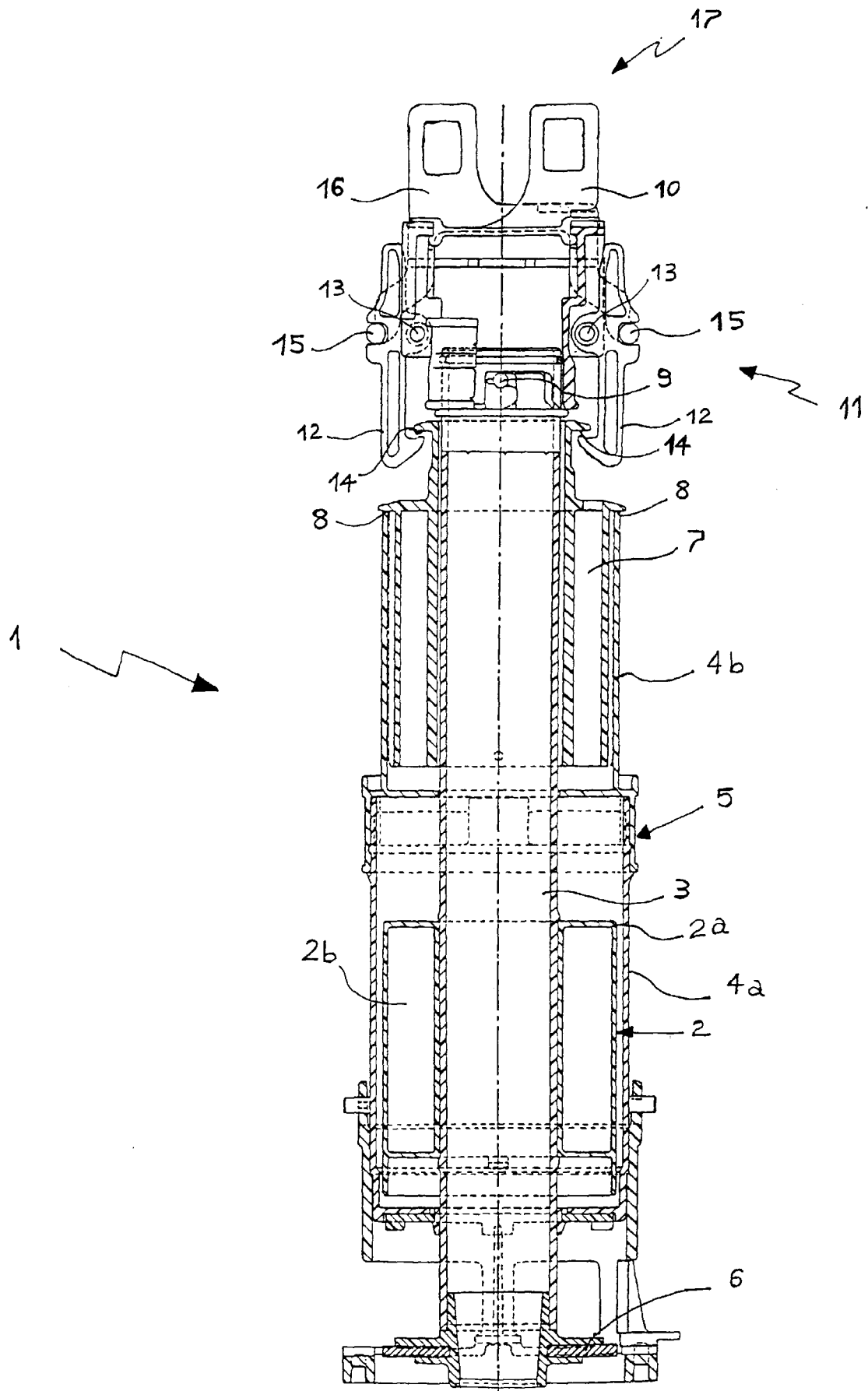
[0022] Clearly, changes may be made to the float and modular-valve system as described herein without, however, departing from the scope of the accompanying Claims.

Claims

1. A float (2) for flush valves, comprising a hollow body (2a) made of synthetic plastic material and defining internally a sealed buoyancy chamber (2b); characterized in that said body is made in one seamless, rigid piece; and in that, in combination, said sealed buoyancy chamber has an inside pressure lower than atmospheric pressure.
2. A float as claimed in Claim 1, characterized by being made from plastic material injected in the fluid state inside a mold, in which a vacuum is subsequently formed while said material is still in the fluid state.
3. A float as claimed in Claims 1 and 2, characterized by being toroidal in shape so as to be fittable to a central tube (3) of a flush valve.
4. A flush valve (1), characterized by comprising a float (2) as described in Claims 1 to 3.

5. A flush valve as claimed in Claim 4, characterized by comprising an actuating device (17) for effecting a partial flush or a total flush.

6. A flush valve system for lavatory flush tanks, characterized by comprising a first number of elements of fixed size, and a second number of elements connectable to the first to form a valve suitable for a predetermined tank; said first number of elements comprising a float as claimed in one of Claims 1 to 3.





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EUROPEAN SEARCH REPORT

Application Number
EP 99 12 0815

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.7)
X	GB 624 704 A (TYCE) * page 1, line 18 - line 28 *	1	E03D1/33 E03D1/14 B29C45/34
Y	* page 2, line 28 - line 29 *	2-6	
Y	DE 43 27 061 A (GOETZ WILHELM) 16 February 1995 (1995-02-16) * column 1, line 3 - line 5 * * column 1, line 15 - line 22 * * column 1, line 59 - line 63 *	2-6	
Y	GB 2 077 790 A (TEN SUNG CHANG) 23 December 1981 (1981-12-23) * abstract * * page 2, line 46 - line 52 * * page 2, line 89 - line 92; figure 1 *	3-6	
A	EP 0 448 092 A (MARABESE DORINO) 25 September 1991 (1991-09-25) * the whole document *	1-6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E03D F16K B29C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 January 2000	Examiner De Coene, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 12 0815

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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