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(54) Improved hydromassaging apparatus, and check valve assembly for such apparatus.

(57) The present invention relates to an improvement in jet bath massaging or hydromassaging apparatus (especially therapeutic bath), which is provided with a plurality of openings connected to air ducts, positionned below a level of water and allowing a pressurized flow of air to bubble into water. The improvement is to mount a check valve across each openings in order to prevent any introduction of water into air ducts. The invention also relates to a check valve especially adapted to embody such an improved hydromassaging apparatus.

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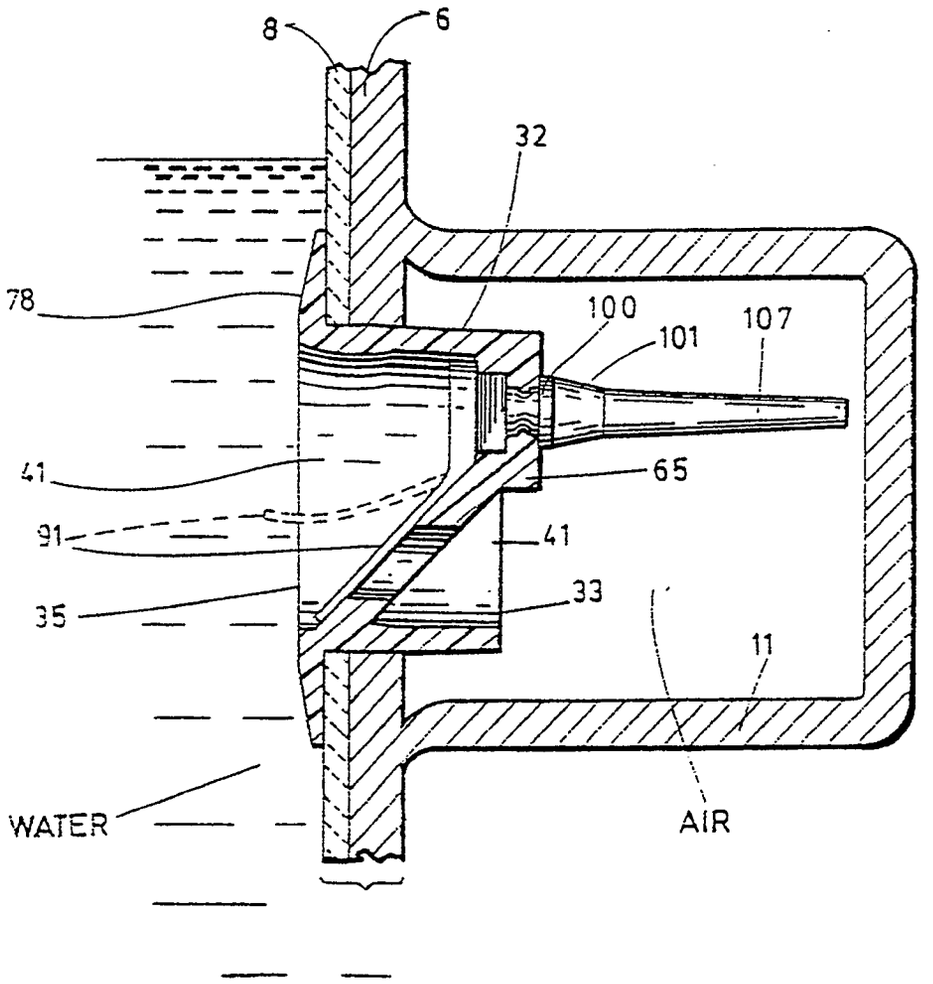

FIG. 12

IMPROVED HYDROMASSAGING APPARATUS, AND CHECK VALVE ASSEMBLY FOR SUCH APPARATUS

BACKGROUND OF THE INVENTION

1(a) Field of the invention

The present invention relates to an improvement in jet bath massaging or hydromassaging apparatus (especially therapeutic bath) which is provided with a plurality of openings positionned below a level of water. The invention also relates to check valves adapted to embody such an improved apparatus.

1(b) Brief description of the prior art

As disclosed in U.S. Pat. no. 4,249,522 there exist a hydromassaging apparatus comprising in combination a tub, compressed air supply means located adjacent the tub, longitudinally extending air distribution duct means secured to the outside surface of the tub, the duct means also comprising air distribution branches and a plurality of small apertures extending through the tub from the air distribution ducts means, the apertures being evenly spaced apart.

Also, as evidenced by U.S. Pat. no. 4,525,881, there exists tubs, spas or pools provided with hydrotherapy jets comprising an air and water check valve. More particularly, such a jet comprised an air and water check valve housed in a valve chamber and adapted to move therein between a seated sealing position preventing the escape of water therethrough from a nozzle, and an open position allowing the passage of air into the chamber from an air inlet passage and out through an outlet port in a nozzle. More particularly, the valve of this U.S. Pat. no. 4,525,881 consists of a cup-shaped cylindrical element concentrically suspended within a cylindrical chamber provided with an air inlet, a water inlet and an outlet for air and water, the element being provided at one end with a rubber disc and being allowed to slide, according to a differential of pressure between the water in the chamber and the atmospheric pressure from a position where the disc abuts with the air inlet (valve is closed) to a position where the disc is move away from said air inlet (valve is open) so as to allow a blend of air and water flowing toward the outlet.

According to U.S. Pat. no. 4,249,522, ducts are designed to be emptied by gravity and then dried by a flow of air circulating therein. There is no means to keep the ducts dry except a special and tedious process for drying the ducts. With tubs, spas or pools of U.S. Pat. no. 4 525 881, there is an air check valve preventing water of tubs, spas or pools from entering the piping that is normally used for introducing a pressurized flow of air and water in tubs, spas or pools. However, this valve always needs the simultaneous use of water and air and would not efficiency work with water or air alone. Therefore, there is either a cumbersome drying process or a sophisticated hydrotherapy jet to prevent water from entering in ducts or pipings. It must be remembered that when water (especially waste water) is allowed to enter the ducts or piping, bacteria and/or fungi are then allowed to grow. These drawbacks negatively affect the sanitariness of the apparatus.

SUMMARY OF THE INVENTION

A first object of the present invention relates to an apparatus which overcomes the aforesaids drawbacks. More particularly, the first object relates to a jet bath massaging or hydromassaging apparatus in which introduction of water toward duct means of the apparatus is prevented in order to keep dry the duct means and thus minimize the risk of having a growth of bacteria and/or fungi therein.

Another object of the invention relates to a hydromassaging apparatus (such as a therapeutic bath) of the type comprising :

a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of the walls being provided with openings below the determined level of water :

generation means adapted to generate a flow of pressurized air ; and

duct means positionned between the openings and means adapted to generate a flow of pressurized air so that said flow can circulate from said generation means through said duct means and openings and then bubble in water ; and

a simple and inexpensive check valve provided in each of saids openings, such that any introduction of water contained in the tub toward its duct means is prevented in order to keep dry duct means and thus minimize the risk of having a growth of bacteria and/or fungi in duct means. (Such introduction of water occured in a prior art hydromassaging apparatus when its tub was filled with water

above side openings and the flow of pressurized air was either shut off or reduced to a value below the pressure of water at openings level.)

Another object of the invention is to provide an improved hydromassing apparatus which results from the mere positionning of a simple and inexpensive check valve across each openings of a hydromassaging apparatus. (example : a hydromassaging apparatus already in use.)

A further object of the invention relates to a check valve assembly which is intended to be positionned across one corresponding opening (especially a side opening) of a hydromassaging apparatus in order (when all openings are each associated with such a check valve) to bring an improvement in a hydromassaging apparatus by preventing any introduction of water contained in the tub toward its ducts means.

A particularly preferred object of the invention relates to a check valve which :

– do not need to be properly oriented around its longitudinal axis to work efficiently (thus further simplify the degree of care to be provided when mounting a check valve in a corresponding opening of an apparatus) ;

– do not need to properly position a flap above the orifice and fastened said flap to a partition with a barbed plug introduced and positionned (i. e. snapped) in a bore located above said orifice.

A still further object of the invention is to provide a check valve assembly that is simple, inexpensive and very easy to mount across a corresponding opening (especially a side opening) of a hydromassaging apparatus, preferably without having to make any modifications to said apparatus.

According to a first embodiment of the invention, the hydromassaging apparatus (such as a therapeutic bath) comprises :

– a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said walls (especially two of said side walls) being provided with openings below said determined level of water ;

– generation means adapted to generate a flow of pressurized air ; and

– duct means positionned in fluid communication between saids openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water. In accordance with the invention, this apparatus is improved in that a check valve is mounted across each of said openings, each check valve comprising a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and means including at least one membrane and being adapted to react to a differential of pressure existing between opposite faces of said membrane and move it either to an open position which allow a fluid communication from the inlet to the outlet, or to a closed position which prevent any fluid communication from the outlet to the inlet, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub. Of course, the casing is axially set and fastened in such a way, according to its longitudinal axis, across a corresponding opening of the tub, that the closure of said means including at least one membrane is achieved when the pressure applied by the water of the tub against one face of the membrane is higher than the pressure applied by the air on the opposite face of this membrane (i.e. check valve closed), and that its opening is achieved when the pressure applied by the pressurized flow of air against one face of the membrane is higher than the pressure applied by the water of the tub against the opposite face of this membrane (i.e. check valve open).

According to another embodiment, the invention relates to a check valve which is intended to be mounted across a corresponding opening of a hydromassaging apparatus of the type comprising :

. a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said walls (especially at least two of said side wall) being provided with openings below said determined level of water ;

. generation means adapted to generate a flow of pressurized air ; and

. duct means positionned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through saids duct means and openings, and then bubble in water.

Such a check valve comprises a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet being intended to be put in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet being intended to be put in fluid communication with an interior of the tub, a conduit extending from said inlet to said outlet and means including at least one membrane and being adapted to react to a differential of pressure existing between opposite faces of said membrane and move it either to an open position which allow a fluid communi-

cation from the inlet to the outlet, or to a closed position which prevent any fluid communication from the outlet to the inlet, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub.

Of course, the casing of the aforesaid check valve is intended to be axially set and fastened in such a way, according to its longitudinal axis, through a corresponding opening of the tub, that when a check valve is mounted through each openings of said wall, for each check valve, the closure of said means including at least one membrane is achieved when the pressure applied by the water of the tub against one face of the membrane is higher than the pressure applied by the air on the opposite face of this membrane (i.e. check valve closed), and its opening is achieved when the pressure applied by the pressurized flow of air against one face of the membrane is higher than the pressure applied by the water of the tub against the opposite face of this membrane (i.e. check valve open).

According to a preferred embodiment of the invention, a check valve comprises :

– A casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet being intended to be put in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet being intended to be put in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with an orifice and transversally positionned across said conduit, said orifice defining the sole passageway of the conduit. The casing is further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub.

– A flexible membrane defining at least in part a flap.

– Means adapted to position and fasten the membrane inside the casing in such a way that when the check valve is closed the flap can cover the orifice and rest against a corresponding portion of the partition that surrounds this orifice and defines a flap seat. The flap seat is provided on a side of the partition facing the outlet.

The casing of the aforesaid preferred check valve is intended to be axially set and fastened in such a way, according to its longitudinal axis, through a corresponding opening of the tub that said flap and seat are substantially inclined with respect to the horizontal and have their lower portion closer of the outlet of the casing. When such a check valve is mounted across each openings of said side walls, for each check valve, said flap can completly cover the flap seat and the orifice when the pressure applied by the water of the tub against one face of the flap is higher than the pressure applied by the air on the opposite face of this flap (i.e. check valve closed), and that the flap can be moved away from said orifice and flap seat when the pressure applied by the pressurized flow of air against one face of the flap is higher than the pressure applied by the water of the tub against the opposite face of this flap (i.e. check valve open).

According to another preferred embodiment, the invention relates to an improved hydromassaging apparatus in which an above mentionned preferred check valve is mounted across each openings of side walls of the tub.

According to a particularly preferred variant of the invention, a check valve may comprise :

– A casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of the casing, said inlet in fluid communication with the duct means, an outlet at the opposite end of the casing, the outlet in fluid communication with an interior of said tub, a conduit extending from the inlet to the outlet and a partition provided with at least one orifice (preferably one orifice) and transversally positioned across the conduit. The orifice defines the sole passageway of the conduit. The casing is further provided with means adapted for axially setting and fastening the check valve to seal a corresponding opening of the tub.

– Means fastened to the casing, including at least one membrane and adapted to react to a differential of pressure existing between opposite faces of the membrane and to move said membrane either to an open position which allow a fluid communication from the inlet to the outlet through said orifice, or to a closed position which prevent any fluid communication from the outlet to the inlet through said orifice. These means including at least one membrane consist, for each orifice of the partition, of a nozzle comprising :

. A sleeve of the type having a longitudinal axis, at least one longitudinal outer surface, opposite ends, a conduit connecting said opposite ends and means adapted for axially setting and fastening it to seal a corresponding orifice in the partition of the casing. One end of the sleeve defines an inlet in fluid communication with duct means. The other end of the sleeve is intended to define an outlet in fluid communication with an interior of the tub.

. A least one membrane (preferably two membranes) having opposite faces, made of resilient and flexible material and partly fastened to (preferably partly integral with) the end defining the outlet of the sleeve. Said membrane(s) is (are) of sufficient size to completely cover and seal the outlet. When the

pressure applied by water of the tub against one face of membrane(s) is higher than the pressure applied by the air on the opposite face of said membrane(s), then the unfastened portion of said membrane(s) is (are) moved against the end of the sleeve to completely covers and seal the outlet (check valve closed) and prevent any fluid communication from the tub to the duct means. When the pressure applied by the air on one face of membrane(s) is higher than the pressure applied by water on the opposite face of said membrane(s), then the unfastened portion of the membrane(s) is (are) moved away from the outlet (check valve open) to allow a fluid communication from the duct means to the tub and thus allow the pressurized air to bubble in water.

Also, according to another particularly preferred embodiment, the invention relates to an improved hydromassaging apparatus of the type comprising : a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said side walls being provided with openings below said determined level of water ; generation means adapted to generate a flow of pressurized air ; duct means positioned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ; and a check valve mounted across each of said openings, each check valve being the preferred variant of a check valve which is described hereinbefore.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be better understood with reference to the following non-restrictive description of preferred embodiments thereof, taken in connection with the accompanying drawings in which :

FIG 1 is a perspective view of a therapeutic bath in which an improvement according to the invention is to be provided ;

FIG 2 is a partial and perspective cross sectional view of a side wall of the bath of FIG 1, which shows a part of one side opening and part of a duct ;

FIG 3 is a front elevational view a casing of a check valve which is intended to be mounted through a corresponding side opening of the bath represented in FIGS 1 and 2 in order to define an improved therapeutic bath according to the invention ;

FIG 4 is a side elevational view of the casing of FIG 3 ;

FIG 5 is a rear elevational view of the casing of FIGS 3 and 4 ;

FIG 6 is a front elevational view of preferred means including a membrane ;

FIG 7 is a side elevational view of means represented in FIG 6 ;

FIGS 8 to 10 illustrate how means represented in FIGS 6 and 7 are positionned and fastened in the conduit of the casing represented in FIGS 3 to 5, to define a check valve according to the invention (the casing is shown in part according to A-A of FIG. 3) ;

FIGS 11 and 12 illustrate how the check valve represented in FIG 10 is axially set and positionned inside a corresponding opening of the bath represented in FIGS 1 and 2 to embody an improvement according to the invention ; and

FIGS 13 and 14 are cross sectional side views of another check valve according to the invention which is usable to embody an improved therapeutic bath according to the invention, said check valve illustrating preferred and alternatives aspects to its structural characteristics.

Figure 15 is a side elevational view of the casing of a particularly preferred variant of a check valve according to the invention, which is intended to be mounted through a corresponding side opening of the bath represented in Figures 1 and 2 in order to define an improved therapeutic bath ;

Figure 16 is a front elevational view of the casing of Figure 15 ;

Figure 17 is a rear elevational view of the casing of Figures 15 and 16 ;

Figure 18 is a side elevational view of particularly preferred means including at least one membrane according to the invention (in closed position) ;

Figure 19 is a rear elevational view of means represented in Figure 18.

Figure 20 is a front elevational view of means represented in Figure 18 ;

Figure 21 is a front elevational view of means represented in Figure 18 (in open position) ;

Figure 22 illustrates how means represented in Figures 18 to 21 are positioned and fastened in the orifice of the casing represented in Figures 15 to 17, to define a check valve according to a variant of the invention (the casing and the nozzle are respectively shown in part according to A-A of Figure 16 and to B-B of Figure 20) ;

Figures 23 and 24 illustrate how the improved check valve represented in Figure 21 is axially set and positioned inside a corresponding opening of the bath represented in Figures 1 and 2 to embody an improvement according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

A therapeutic bath " B" in which an improvement according to the invention can be made, comprises, as illustrated in FIGS 1 and 2, a tub having a bottom 1, opposite side walls 5 provided with a plurality of evenly spaced openings 9, opposite side walls 7, ducts 11 and means adapted to generate a flow of pressurized air, circulate it through saids ducts 11 and openings 9 and then bubble it (under jet form) in water "W". The tub is filled with water "W" to a level "L". In use, this level "L" is always above openings 9. In fact, openings 9 may be advantageoulsy positionned in walls 5 close to bottom 1, so as to maximize the distance between said openings and the level "L" and thus increase the path of bubbles across water "W" to thereby increase movement of water "W" generated by said bubbles.

More particularly, means adapted to generate a flow of pressurized air may consist of a fan 13 operated by an electric motor and provided with an outlet 15 which is put in fluid communication with ducts 11 by any appropriate means well known to one skilled in the art. (e.g. pipe fitting, etc...).

Preferably, walls 5 and 7 consist of a sheet 6 (made of metal (such as steel), plastic or fiber glass) and one layer 8 of an appropriate coating (such as enamel, acrylic, gel coal, etc). Also, ducts 11 may be made with a sheet of metal (such as steel),plastic or fiber glass. Preferably, a portion of ducts 11 is integral with sheet 6. Of course, one skilled in the art is well aware of how a therapeutic bath (such as the one of U.S. Pat. no. 4 249 522) has to be built. Therefore, it is not necessary to provide further particulars about walls 5 and 7, ducts 11, fan 13 and openings 9.

The improvement to this bath "B" may consist of a check valve "CV" (or "CV'") as shown in FIGS 3 to 14, mounted across each opening 9 in order to allow a pressurized flow of air generated by the fan 13 to circulate successively through said ducts 11 and through said check valve "CV" (or "CV'") mounted through said openings 9, and then to bubble in water "W", and, when the fan 13 is stopped, to prevent any introduction of water "W" toward said ducts 11. The use of check valve "CV" (or "CV'") allow to keep dry ducts 11 and thus prevent any growth of bacteria and/or fungi therein.

More particularly, check valve "CV" shown in FIGS 3 to 12 comprises a casing 31 provided with :

– a conduit 41 positionned between an inlet 33 and an outlet 35 and comprises, across said conduit 41 a partition provided with an orifice 53 ;

– a flexible membrane defining at least in part a flap. This membrane may advantageously consist of a strip of elastomeric material which (when the check valve is closed) will completly cover the orifice 53 and rest against a flap seat defined by a corresponding portion of the partition surrounding the orifice 53 ;

– means adapted to position and fasten the membrane inside the casing in such a way that the flap covers said orifice 53 and rests against the corresponding portion of the partition that surrounds orifice 53 (i.e. flap seat), said flap being provided on a side of said partition facing said outlet. Advantageously, means adapted to position and fasten the membrane inside the casing 31 consist of one bore (eventually more than one bore) provided through an upper portion of the partition and at least one barbed plug of such size and geometry to fit tight in a corresponding bore ;

– means adapted for axially setting and fastening said casing 31 in a corresponding opening 9 of the bath "B".

More particularly, casing 31 has a circular cross section according to a plane perpendicular to its longitudinal axis, and, as shown in FIGS 3 to 5, comprises partition having a lower section 63 which is inclined with respect to the longitudinal axis of the casing, and having an upper section 61 which is perpendicular with the longitudinal axis of said casing. The upper section 61 is preferably provided with a bore having two coaxial segments of differential cross section. An orifice 53 is provided in section 63. Advantageoulsy, the orifice 53 has its longitudinal axis parallel with the longitudinal axis of the casing 31. Preferably, the upper section 61 makes an integral part with a protuberance 65 which is intended to locally increase the thickness of section 61. A bore is provided through saids section 61 and protuberance 65. This bore has its longitudinal axis parallel with the longitudinal axis of casing 31 and presents two distincts segments 79 and 81. Segment 79 has a square cross section and segment 81 has a circular cross section. Segment 81 is also provided, as shown in FIGS 3 to 5 and 8 to 12 with a protuberance 83.

More particularly, means for axially setting and fastening casing 31 of check valve "CV" to seal a corresponding opening 9 (which is provided with an inner cylindrical surface 111 (see FIG. 11)) may consist of :

– A collar 71 comprising a portion 73 of cylindrical outer surface and, eventually a portion 75 of conical outer surface. The cylindrical surface of portion 73 has a diameter slightly greater than the diameter of cylindrical surface 111. The diameter of cylindrical surface 111 of an opening 9 may be either the one of an opening provided in a therapeutic bath already in use or the one resulting of the drilling of such an opening with a drill of appropriate diameter. (e.g. 0.50 inch).

– A flange 77 which radially extends a part of the cylindrical surface of portion 73 and is provided with opposite radial faces 78 and 78a which may be, preferably slightly conical and convergent. Face 78 may define, advantageously, a cup (especially a suction or sealing cup). Casing 31 is provided with a slightly conical outer longitudinal surface 32. Its diameter at inlet end of the casing is preferably smaller than the diameter of surface 111.

Casing 31, collar 71, partition 51 and protuberance 65 are advantageoulsy integral to each other and are preferably made with an appropriate plastic material. (They may be manufactured by usual moulding technics) An example of a preferred plastic material is SANTOPRENE (trade mark), especially SANTOPRENE having a shore "A" durometer value ranging from 82 to 92 (i.e. 87 ± 5).

More particularly, means including a membrane, may consist, advantageously, of a membrane 55 made of elastomeric material. (They may be manufactured by usual moulding technics) (An example of preferred elastomeric material is a silicone rubber, especially a silicone rubber having a Shore "A" durometer value ranging from 3 7 to 4 3 (i. e. 40 ± 3)). This membrane has opposite faces and is provided with a lower segment defining a flap 91 and an upper segment 92 whose one face makes an integral part with one end of plug 93 also made of elastomeric material.

Advantageously, plug 93 which defines a barbed plug, comprises three distintives sections 95, 97 and 99 which integrally extend each other along the longitudinal axis of said plug 93.

Section 95 defines a head for said plug, has opposite ends and has one of its ends integral with a corresponding portion of one face of the upper segment 92. Advantageously, this section 95 may be provided with means adapted to prevent any axial rotation of plug 93 along to its longitudinal axis. Preferably, such means is achieved when section 95 is of such size and geometry that it can fit tight inside bore segment 79 having a square cross section.

Section 97 defines a central body for said plug and has a cross section smaller than the one of section 95. This section 97 has opposite ends and such size and geometry that it can fit tight in the bore section 81.

Section 99 defines a tail for said plug and comprises three distinctives segments 100, 101 and 102 which integrally extend each other along the longitudinal axis of said section 99. Section 100 has opposite ends, has a cross section that is larger than the one of section 97 and has one of its end integral with a corresponding end of section 97. Section 101 has a conical outer surface whose larger cross section is equal to the cross section of segment 100. Segment 102 has a slight conical surface whose larger cross section is equal to the smaller cross section of segment 101. Preferably, the smaller cross section of segment 102 may be slightly smaller than the cross section of section 97.

Section 97 defines a groove between radial walls 96 and 98 of sections 95 and 100. Thus, sections 95 and 99 each defines a stopper (or barb) for axially setting and fixing the plug 93 in section 61 and positionning flap 91 in such a way, inside conduit 41 that, as shown in FIG 12, when the check valve "CV" is closed, flap 91 covers orifice 53 and rests against a corresponding portion of section 63 of the partition, said corresponding portion of section 63 defining a flap seat. When the check valve "CV" is open, flap 91 can be bent toward the outlet 35 and raised above orifice 53 and flap seat.

To positioned and fastened means including a membrane inside the conduit 41, the following steps are carried out :

. The free end of segment 102 is introduced successively through bore segments 79 and 81 ;

. segment 102 is grasped by any appropriate means (such as pincers) and pulled until section 100, 101 and 102 were forced through section of bore 79, protuberance 83 and second section of bore 81, and sections 95 and 97 were housed tightly within bore segments 79 and 81 respectively. Protuberance 83 pinches outer surface of section 97 in order to further seal the plug 93 in the section 81 and avoid any leak between said plug 93 and bore sections 79 and 81. When the plug 93 is fastened within sections of bore 79 and 81, and there is no differential of pressure between opposite faces of flap 91, this latter rests against the flap seat defined by a portion of section 63 and covers orifice 53.

For mounting a check valve "CV" in a corresponding opening 9, the following steps are carried out :

– The inlet end of casing 31 is axially aligned with the axis of opening 9 (which may have been drilled, if necessary, to increase its diameter when check valve "CV" has to be mounted through a corresponding side opening of an existing therapeutic bath).

– Surface 32 is engaged in said opening 9 and then casing 31 is axially pushed (with hands) until surface 111 contact either surface 32 or, preferably, portion 75. Then casing 31 is axially pushed in opening 9 (with hands or, if necessary, with an appropriate tool such as a hammer) until surface 111 is successively forced over the remaining portion of surface 32, if any, and over portions 75 and 73, and until face 78 abuts with coating 8 and be slightly disformed to become substantially plane instead than conical. Face 78 may define a suction or sealing cup. Under the pressure exerted by surface 111 against portion 73, the casing 31 is slightly disformed and friction existing between surface 111 and

cylindrical surface of portion 73 is sufficient to seal and retain the casing in said opening.

To remove a casing 31 of check valve "CV" from an opening 9, one only has to inverse the aforesaid sequence and used his fingers or appropriate tools (such as crow bar or the blade of a screwdriver).

Of course, it should be possible to use an adhesive or cement between surface 111 and portion 73 to further seal the casing 31 in the opening 9. However, this is facultative and friction existing between surface 111 and portion 73 as well as suction that may be generated by face 78 against coating 8 are generally sufficient to seal the casing in opening 9 and make opening 53 the sole passageway through which a pressurized flow of air can flow.

More particularly, check valve "CV'" shown in FIGS 13 and 14 is similar to check valve "CV" except the following alternatives particulars :

– section 63' is thicker near the lower part of the conduit 41' and is provided with a protuberance 54 around orifice 53' ; and/or

– section 99' defines a tail for said plug and comprises two distinctives segments 104 and 105. Section 104 has opposite ends, a conical cross section and its end of larger cross section larger than the one of section 97 and is integral with a corresponding end of section 97. Segment 105 has a slight conical surface whose end having the larger cross section is equal to the smaller cross section of segment 104.

Other particulars of this check valve "CV'" are identical to the ones of check valve "CV".

In use, a preferred improved therapeutic bath according to the invention which is defined by the combination of a bath "B" as shown in FIGS 1 and 2 with a check valve "CV" as shown in FIGS 12 mounted through each of its openings 9, works as follows :

The tub of bath "B" is filled with water by any appropriate means well known to one skilled in the art (e.g. faucets 112 shown in FIG 1) to a level "L" which is set above saids check valves "CV". Then, for each check valve "CV", water "W" applies a pressure against one face of flap 91 and press it against the flap seat defined by a portion of wall 63 surrounding orifice 53 and cover said orifice 53 in order to close the check valve "CV" and prevent any flow of water "W" from the outlet 35 toward the inlet 33. Thus, ducts 11 are kept dry.

Then, fan 13 is started and a flow of pressurized air is allowed to circulate through ducts 11 and conduits 41 and then to bubble (especially in jet form) in water. Of course, the force exerted by the pressurized flow of air against one face of each flap 91 ought to be greater than the force exerted by water "W" against opposite face of saids flaps so that each flap can be bent toward outlet 35 (see dotted lines in FIG 12) and moved away from orifice 53 to allow a fluid communication between inlet 33 and outlet 35 and allow to pressurized flow of air to create jet of bubbles in water "W". (N.B. Jet of bubbles was voluntary omitted in Figure 12 for clarity by purpose). When the fan is stopped, pressure applied by water against one face of each flap 91 become greater than pressure of air contained in ducts 11 and applied against opposite face of each flap 91. When this occurs, each flap 91 is push by water against section 63 to cover orifice 53 and prevent any fluid communication between outlet 35 and inlet 33 through said orifice 53.

Water contained in the bath "B" may be removed by any appropriate means well known to one skilled in the art (e.g. a drain 113 provided in the bottom 1).

An improved therapeutic bath according to the invention can also result from the combination of the bath "B" (shown in FIGS 1 and 2) with a check valve "CV'"(shown in FIGS 13 and 14) mounted across each openings 9. Such an improved bath works in the same way than an improved bath using a check valve "CV". Protuberance 54 contributes to further improve the tightness of valve "CV" when this latter is closed.

According to a particularly preferred variant, the invention relates to an improvement to a bath "B", as illustrated in Figures 1 and 2. This improvement consists of a check valve variant "CV2" as shown in Figures 15 to 24, mounted across each opening 9 in order to allow a pressurized flow of air generated by the fan 13 to circulate successively through said ducts 11 and through said check valve "CV2" mounted through said openings 9, and then to bubble in water "W", and, when the fan 13 is stopped to prevent any introduction of water "W" toward said ducts 11. The use of check valve "CV2" allow to keep dry ducts 11 and thus prevent any growth of bacteria and/or fungi therein.

According to a particularly preferred embodiment, the invention relates to a check valve variant of the type comprising :

– A casing 331 having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface 332, an inlet 333 intented to be in fluid communication with said duct means 11, an outlet 335 intended to be in fluid communication with an interior of said tub, a conduit 341 extending from the inlet 333 to the outlet 335 and a partition 363, provided with an orifice 353 and transversally positionned across said conduit 341 (advantageously near the inlet 333 and preferably flush with the inlet 333). This orifice 353 defines the sole passageway of the conduit 341. According to a particularly preferred embodiment, the orifice 353 may be provided with a protuberance 383. The casing is further provided with means adapted for axially setting and fastening said check valve to seal a corresponding

opening of the tub.

– Means fastened to the casing 331, including at least one membrane and adapted to react to a differential of pressure existing between opposite faces of said membrane and to move it either to an open position which allow a fluid communication from the inlet 333 to the outlet 335 through said orifice 353, or to a closed position which prevent any fluid communication from the outlet 335 to the inlet 333 through said orifice 353.

More particularly, said means including at least one membrane is a nozzle comprising :

– a sleeve 401 made of resilient and flexible material, provided with a longitudinal axis and having two distinctive sections 405 and 407 which integrally extend each other along the longitudinal axis of said sleeve 401.

The first section 405 has opposite ends, a wall connecting said ends together and defining a conduit 409 (see Figure 22) therebetween, a longitudinal axis concentric with the longitudinal axis of said sleeve 401, and at least one longitudinal outer surface 411.

One end of the section 405 is intended to be in fluid communication with said duct means 11, and defines an inlet 413 to the nozzle. This section 405 is further provided with means adapted for axially setting and fastening said first section 405 to seal a corresponding orifice 353 in the casing 331.

The second section 407 has opposite ends, a wall having an inner surface 415, an outer surface 417 and connecting said ends together to define a conduit 419 (which preferably has a frustum geometry, see Figures 22 to 24) therebetween, a longitudinal axis concentric with the longitudinal axis of said sleeve 401. One end of section 407 is integral with the end of section 405 opposite to the inlet 413 of the section 401. Conduits 409 and 419 communicate together. The other end of section 407 is shaped to define opposite lips, preferably two opposite lips 421. More particularly, for each lip 421, a segment of the wall of the second section 407 defines a membrane 427 made of resilient and flexible material. Advantageously, this material is further provided with elastic properties and two or more lips 421 are positionned in such a way (one with respect to the other) that when there is no differential of pressure between opposite faces of each membrane 427, they are brought and kept one against the other by the mere elastic force of membranes 427. The end of the section 407 that is opposite the end integral with section 405 is intended, when lips 421 are separated from each other, to define the outlet 429 (see Figures 21 and 24) of the nozzle and to be in fluid communication with an interior of the tub. According to another particularly preferred embodiment of the invention, each lip 421 of each membrane 427 is bevelled in order to increase the surface of contact between said lips 421 when the outlet is closed.

When the pressure applied by water "W" of the tub against one face 417 of each membrane 427 (plus eventually the elastic force of membranes that may bring and keep lips 421 one against the other) is higher than the pressure applied by the air on the opposite face 415 of membranes 427, then lips 421 are brought and kept one against the other (check valve closed) to prevent any fluid communication from the tub to the duct means.

When the pressure applied by the air on face 415 of each membrane 427 is higher than the pressure applied by water "W" on the opposite face 417 of said membrane 427 (plus eventually the elastic force of membranes that may bring and keep lips 421 one against the other), then membranes 427 and lips 421 are disformed and lips 421 are separated from each other to allow a fluid communication from the duct means to the tub (check valve open) and thus allow the pressurized air to bubble in water.

According to a particularly preferred embodiment of the invention, means adapted to position and fasten the sleeve 401 inside the orifice 353 of the casing 331 consist of a pair of protuberances 395 and 397 integral with said longitudinal outer surface 411 of section 405 and provided with radial faces 396 and 398, said radial faces being intended to contact opposite faces of the partition wall 363.

More particularly, means for axially setting and fastening casing 331 of check valve "CV2" to seal a corresponding opening 9 (which is provided with an inner cylindrical surface 111 (see Figure 23)) may consist of :

– A collar 371 comprising a portion 373 of cylindrical outer surface and, eventually a portion 375 of conical outer surface. The cylindrical surface of portion 373 has a diameter slightly greater than the diameter of cylindrical surface 111 (see Figure 23). The diameter of cylindrical surface 111 of an opening 9 may be either the one of an opening provided in a therapeutic bath already in use or the one resulting of the drilling of such an opening with a drill of appropriate diameter.

– A flange 377 which radially extends a part of the cylindrical surface of portion 373 and is provided with opposite radial faces 378 and 378a which may be, preferably slightly conical and convergent. Face 378 may define, advantageously, a cup (especially a suction or sealing cup). Casing 331 is provided with a slightly conical outer longitudinal surface 332. Diameter of surface 332 at or near the inlet end 333 of the casing is preferably smaller than the diameter of surface 111, to facilitate the alignment of the casing 331 in the opening 9. Preferably a portion 332a of surface 332 may be more conical in order to further facilitate the initial alignment of the casing 331 in the opening 9.

Casing 331, collar 371, partition 363 and protuberance 383 are advantageously integral to each other and

are preferably made with an appropriate plastic material. They are preferably obtained by conventional moulding technics. An example of a preferred plastic material is SANTOPRENE (trade mark), especially SANTOPRENE having a shore "A" durometer value ranging from 82 to 92 (i.e. 87 ± 5).

Advantageously both sections 405 and 407 are made with an elastomeric material. Advantageously, section 407 comprises two protuberances 395 and 397 which radially extend from the outer surface 411. Section 407 and protuberances 395 and 397 may be of any appropriate elastomeric material. Preferably, section 405, membranes 427, lips 421, section 407 and protuberances 395 and 397 are integral to each other and made with an elastomeric material and they are preferably obtained by conventional moulding technics. The elastomeric material is advantageously selected amongst those having resilience, flexibility and elastic properties. (An example of preferred elastomeric material is a silicone rubber, especially a silicone rubber having a Shore "A" durometer value ranging from 27 to 43 advantageously 27 to 33 (i.e. 30 ± 3)).

When the sleeve 401 is fastened inside orifice 353 and when there is no differential of pressure between opposite faces of membrane 427, lips 421 are preferably brought one against the other by the mere elasticity of the elastomeric material.

To position and fasten the sleeve 401 of a nozzle inside the orifice 353, the following steps are carried out:

. The free end of section 407 is introduced successively through the orifice 353 toward the outlet 335. The orifice 353 is advantageously further provided with a protuberance 383 ;

. Membranes 427 are grasped by any appropriate means (such as pincers) and pulled until protuberance 395 is forced through the orifice 353. Distance between protuberances 395 and 397 are advantageoulsy smaller than the thickness of partition 363 so as to allow section 407 to be housed tightly within the orifice 353 (because the elasticity of the material defining the nozzle). Advantageously, a protuberance 383 may pinch outer surface 411 between protuberances 395 and 397 in order to further seal section 407 in the orifice 353 and further avoid any risk of leak between said section 407 and the orifice 353. Advantageously, the diameter of surface 411 between radical faces 396 and 398 is slightly greater than the diameter define by the orifice 353 and/or eventually protuberance 383. (Preferably, the diameter of surface 411 between radial faces 396 and 398 is slightly greater than the diameter defines by protuberance 383. Then, surface 411 is slightly disformed as illustrated in Figures 23 and 24).

To remove the sleeve 401 of the nozzle from the orifice 353, one only has to inverse the aforesaid sequence and grasp protuberance 397 by any appropriate means (such as pincer) and pull until protuberance 395 is forced through the orifice 353.

For mounting a check valve "CV2" in a corresponding opening 9, the following steps are carried out :

– The inlet end 333 of casing 331 is axially aligned with the axis of opening 9 (which may have been drilled, if desired or if necessary, to increase its diameter when check valve "CV2" has to be mounted through a corresponding side opening of an existing therapeutic bath).

– Surface 332 is engaged in said opening 9 and then casing 331 is axially pushed (with hands) until surface 111 contact either surface 332 or, preferably, portion 375. Then casing 331 is axially pushed in opening 9 (with hands or, if necessary, with an appropriate tool such as a hammer) until surface 111 is successively forced over the remaining portion of surface 332, if any, and over portions 375 and 373, and until face 378 abuts with coating 8 and be slightly disformed to become substantially plane instead than conical. Face 378 may define a suction or sealing cup. Under the pressure exerted by surface 111 against portion 373, the casing 331 is slightly disformed and friction existing between surface 111 and cylindrical surface of portion 373 is generally sufficient to seal and retain the casing 331 in said opening 9.

To remove a casing 331 of check valve "CV2" from an opening 9, one only has to inverse the aforesaid sequence and use his fingers or appropriate tools (such as crow bar or preferably the blade of a screwdriver).

Of course, it should be possible to use an adhesive or cement between surface 111 and portion 373 to further seal a casing 331 in a corresponding opening 9.

However, this is facultative and friction existing between surface 111 and portion 373 as well as suction that may be generated by face 378 against coating 8 are generally sufficient to seal the casing in opening 9 and make orifice 353 the sole passageway through which a pressurized flow of air can flow.

In use, a preferred improved therapeutic bath according to the invention which is defined by the combination of a bath "B" as shown in Figures 1 and 2 with with a improved check valve "CV2" as shown in Figure 24 mounted through each of its openings 9, works as follows :

The tub of bath "B" is filled with water by any appropriate means well known to one skilled in the art (e.g. faucets 112 shown in Figure 1) to a level "L" which is set above said check valves "CV2". Then, for each check valve "CV2", water "W" applies a pressure against one face of membranes 427 and press (or eventually further press) the lips 421 one against the other, in order to close the check valve "CV2" and prevent any flow of water "W" from the outlet 335 toward the inlet 333. Thus, ducts 11 are kept dry.

Then, fan 13 is started and a flow of pressurized air is allowed to circulate through ducts 11 and conduits 409, 419 and 341, and then to bubble (especially in jet form) in water. Of course, the force exerted by the pressurized flow of air against face 415 of each membranes 427 ought to be greater than the force exerted by water "W" against opposite face 417 of said membranes 427 (plus eventually the elastic force of membrane that may contribute to bring and keep lips one against the other), so that membranes 427 and lips 421 can be disformed and lips 421 be moved away from each other to allow a fluid communication between inlet 333 and outlet 335 and allow to pressurize flow of air to create jet of bubbles in water "W". (N.B. Jet of bubble was voluntary omitted in Figure 24 for clarity purpose).

When the fan is stopped, pressure applied by water against face 417 of each membrane 427 (plus eventually the elastic force of membrane that may contribute to bring and keep lips 421 one against the other), become greater than pressure of air contained in ducts 11 and applied against opposite face 415 of each membrane 427. When this occurs, lips 421 are brought and kept one against the other to prevent any fluid communication between outlet 335 and inlet 333 through said orifice 353.

Water contained in the bath "B" may be removed by any appropriate means well known to one skilled in the art (e.g. a drain 113 provided in the bottom 1).

As a non-limitative example, check valves according to the invention may have the following size characteristics :

- diameter of surface 73 or 373 (when intended to be introduced in an opening 9 whose surface 111 has a diameter of 0.50 inch) .....0.52 inch
- diameter of flange 77 or 377 .....0.77 inch
- lenght of casing 31 or 331 between inlet 33 or 333 and outlet 35 or 335) .....0.43 inch

With respect to check valve "CV2":

- diameter of orifice 353 .....0.354inch
- diameter of surface 411 .....0.354inch
- diameter of protuberance 395 .....0.374inch
- diameter of protuberance 397 .....0.46 inch
- diameter of conduit 309 .....0.222inch
- lenght of nozzle (between inlet 413 and outlet 429).....0.48 inch

Again, the above-mentioned preferred embodiments of the invention are not limitative, and therefore, the invention also extends to any variants or equivalents that would be obvious for person skilled in the art.

Claims

1. In a hydromassaging apparatus of the type comprising :
   . a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said walls being provided with openings below said determined level of water ;
   . generation means adapted to generate a flow of pressurized air ; and
   . duct means positionned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ;
   the improvement wherein a check valve is mounted across each of said openings, each check valve comprising a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and means including at least one membrane and being adapted to react to a differential of pressure existing between opposite faces of said membrane and move it either to an open position which allow a fluid communication from the inlet to the outlet, or to a closed position which prevent any fluid communication from the outlet to the inlet, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub.

2. In a hydromassaging apparatus of the type comprising :
   . a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said side walls being provided with openings below said determined level of water;
   . generation means adapted to generate a flow of pressurized air ; and
   . duct means positionned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ;
   the improvement wherein a check valve is mounted across each of said openings, each check valve comprising :
   - a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with an orifice and transversally positionned across said conduit, said orifice defining the sole passageway of the conduit, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub,
   - a flexible membrane defining at least in part a flap ; and
   - means adapted to position and fasten the membrane inside the casing in such a way that the flap covers said orifice and rests against a corresponding portion of the partition that surrounds this orifice and defines a flap seat, said flap being provided on a side of said partition facing said outlet ;
   with the proviso that the casing is axially set and fastened in such a way, according to its longitudinal axis, across a corresponding opening of the tub, that said flap and seat are substantially inclined with respect to the horizontal and have their lower portion closer of the outlet of the casing, and that said flap can completly cover the flap seat and the orifice when the pressure applied by the water of the tub against one face of the flap is higher than the pressure applied by the air on the opposite face of this flap (i.e. check valve closed), and that said flap can be moved away from said orifice and flap seat when the pressure applied by the pressurized flow of air against one face of the flap is higher than the pressure applied by the water of the tub against the opposite face of the flap (i.e. check valve open).

3. A hydromassaging apparatus according to claim 2, wherein the membrane consists of a strip of elastomeric material which (when the check valve is closed) completly covers the orifice and rests against the flap seat, and wherein means adapted to position and fasten the membrane inside the casing consist of at least one bore provided through an upper portion of the partition, and at least one barbed plug of such size and geometry to fit tight in a corresponding bore.

4. A hydromassaging apparatus according to claim 3, wherein the bore has two coaxial segments of different cross-section and wherein the barbed plug is made of elastomeric material and comprises three distinctive sections which integrally extend each other along the longitudinal axis of said plug,
   - a first section defining a head for said plug, having opposite ends, one end thereof extending one end of a central body, having a cross section greater than the cross section of said central body and having its opposite end integral with a portion of the strip ;
   - a second section defining the central body for said plug and having a cross section smaller than the one of the first section, said second section having opposite ends ;
   - a third section defining a tail for said plug and having opposite ends, one end of said third section extending the remaining end of the central body and having a cross section greater than the one of the second section, while opposite end of said third section is taper according to the longitudinal axis of said plug ;

   with the proviso that the segments of the bore are of such size and geometry that saids first and second sections of the plug fit tight and completly therein, that the positionning of the second section which defines a notch in the lateral surface of the plug, in its corresponding segment of the bore involve that the first and third sections of the plug define stoppers for axially setting and fixing the plug in the upper portion of the partition and for positionning the flap in such a way inside the casing that when the check valve is closed, said flap can cover the orifice and rest against the flap seat, and when the check valve is open, said flap can be raised above said orifice and flap seat.

5. A hydromassaging apparatus according to claim 4, wherein the first section of the plug and its corresponding segment of bore are provided with means adapted to prevent any axial rotation of said plug along to its longitudinal axis.

6. A hydromassaging apparatus according to claim 5, wherein :
   - the partition consists of two distinctives sections, integral to each other and with the casing, one of said sections defining an upper portion whose one side faces the outlet and is substantially perpendicular with respect to the longitudinal axis of said casing, the other of said sections defining a lower portion which is provided with said orifice, and whose one side faces the outlet, defines a seat for the flap and is inclined with respect to the longitudinal axis of the casing ;
   - the strip of elastomeric material has opposite faces and comprises two distintives sections, integral to each other, one of said sections defining an upper portion whose a portion of one of its faces is integral with a corresponding end of the head of the plug, the other of said sections defining a lower portion which is intended to define the flap.

7. A hydromassaging apparatus according to claim 6, wherein means for axially setting and fastening the check valve to seal corresponding opening of a side wall of the tub, consist of :
   . an opening of circular cross section which defines a cylindrical surface of contact in said side wall, said cylindrical surface having a diameter ;
   . a collar making an integral part with the longitudinal outer surface of the casing and being provided with an outer cylindrical surface having a diameter slightly greater than the one of the cylindrical surface of the opening ;
   . a flange having opposite faces that radially extend from a portion of the outer cylindrical surface of the collar, said flange being positionned near the outlet of the casing, so that the cylindrical surface of the collar contacts the cylindrical surface of the opening and that one face of the flange contacts a side wall portion surrounding this opening.

8. A hydromassaging apparatus according to claim 6, wherein the flap seat surrounding the orifice is further provided with a small protuberance that is concentric with said orifice and wherein the flap follows the shape of this protuberance.

9. A hydromassaging apparatus according to claim 6, wherein a portion of the free end of the third section of the plug has a cross section at least slightly smaller than the cross section of the second section of the plug.

10. A check valve intended to be mounted across a corresponding opening of a hydromassaging apparatus of the type comprising :
   . a tub having a bottom wall and side walls and being intended to be filled with water to a determined

level, at least one of said walls being provided with openings below said determined level of water ;
. generation means adapted to generate a flow of pressurized air ; and
. duct means positionned in fluid communication between said openings and generation means adapted to generate a flow of pressurized air so that said flow can circulate from said generation means through saids duct means and openings and then bubble in water ;
wherein said check valve comprises a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet being intended to be put in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet being intended to be put in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and means including at least one membrane and being adapted to react to a differential of pressure existing between opposite faces of said membrane and move it either to an open position which allow a fluid communication from the inlet to the outlet, or to a closed position which prevent any fluid communication from the outlet to the inlet, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub.

11. A check valve according to claim 10, and intended to be mounted across a corresponding opening provided in a side wall of the hydromassaging apparatus, wherein said check valve comprises :
- a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet being intended to be put in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet being intended to be put in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with an orifice and transversally positionned across said conduit, said orifice defining the sole passageway of the conduit, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub,
- a flexible membrane defining at least in part a flap ; and
- means adapted to position and fasten the membrane inside the casing in such a way that the flap covers said orifice and rests against a corresponding portion of the partition that surrounds this orifice and defines a flap seat, said flap being provided on a side of said partition facing said outlet ; with the proviso that the casing is intended to be axially set and fastened in such a way, according to its longitudinal axis, across a corresponding opening of the tub, that said flap and seat are substantially inclined with respect to the horizontal and have their lower portion closer of the outlet of the casing, and that said flap can completly cover the flap seat and the orifice when the pressure applied by the water of the tub against one face of the orifice is higher than the pressure applied by the air on the opposite face of this flap (i.e. check valve closed), and that said flap can be moved away from said orifice and flap seat when the pressure applied by the pressurized flow of air against one face of the flap is higher than the pressure applied by the water of the tub against the opposite face of this flap (i.e. check valve open).

12. A check valve according to claim 11, wherein the membrane consists of a strip of elastomeric material which (when the check valve is closed) completly covers the orifice and rests against the flap seat, and wherein means adapted to position and fasten the membrane inside the casing consist of at least one bore provided through an upper portion of the partition, and at least one barbed plug of such size and geometry to fit tight in a corresponding bore.

13. A check valve according to claim 12, wherein the bore has two coaxial segments of different cross section, and wherein the barbed plug is made of elastomeric material and comprises three distinctive sections which integrally extend each other along the longitudinal axis of said plug,
- a first section defining a head for said plug, having opposite ends, one end thereof extending one end of a central body, having a cross section greater than the cross section of said central body and having its opposite end integral with a portion of the strip ;
- a second section defining the central body for said plug and having a cross section smaller than the one of the first section, said second section having opposite ends ;
- a third section defining a tail for said plug and having opposite ends, one end of said third section extending the remaining end of the central body and having a cross section greater than the one of the second section, while opposite end of said third section is taper according to the longitudinal axis of said plug ;
with the proviso that the segments of the bore are of such size and geometry that saids first and second sections of the plug fit tight and completly therein, that the positionning of the second section which defines a notch in the lateral surface of the plug, in its corresponding segment of the bore involve that the first and

third sections of the plug define stoppers for axially setting and fixing the plug in the upper portion of the partition and for positionning the flap in such a way inside the casing that when the check valve is closed, said flap can cover the orifice and rest against the flap seat, and when the check valve is open, said flap can be raised above said orifice and flap seat.

14. A check valve according to claim 13, wherein the first section of the plug and its corresponding section of bore are provided with means adapted to prevent any axial rotation of said plug along to its longitudinal axis.

15. A check valve according to claim 14, wherein :

- the partition consists of two distinctives sections, integral to each other and with the casing, one of said sections defining an upper portion whose one side faces the outlet and is substantially perpendicular with respect to the longitudinal axis of said casing, the other of said sections defining a lower portion which is provided with said orifice, and whose one side faces the outlet, defines a seat for the flap and is inclined with respect to the longitudinal axis of the casing ;
- the strip of elastomeric material has opposite faces and comprises two distintives sections, integral to each other, one of said sections defining an upper portion whose a portion of one of its faces is integral with a corresponding end of the head of the plug, the other of said sections defining a lower portion which is intended to define a flap.

16. A check valve according to claim 15, wherein means for axially setting and fastening the check valve across a corresponding opening of the tub, said opening having a circular cross section which defines a cylindrical surface of contact in said side wall, and said cylindrical surface having a diameter, consist of :

. a collar making an integral part with the longitudinal outer surface of the casing and being provided with an outer cylindrical surface having a diameter slightly greater than the one of the cylindrical surface of the opening ;

. a flange having opposite faces that radially extend from a portion of the outer cylindrical surface of the collar, said flange being positionned near the outlet of the casing, so that when the cylindrical surface of the collar will contact the cylindrical surface of the opening, the flange contacts the side wall surrounding the opening.

17. A check valve according to claim 15, wherein the flap seat surrounding the orifice is further provided with a small protuberance that is concentric with the orifice and wherein the flap follows the shape of this protuberance.

18. A check valve according to claim 15, wherein a portion of the free end of the third section of the plug has a cross section at least slightly smaller than the cross section of the second section of the plug.

19. In a hydromassaging apparatus of the type comprising : a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said side walls being provided with openings below said determined level of water ; generation means adapted to generate a flow of pressurized air ; duct means positioned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ; the improvement wherein a check valve is mounted across each of said openings, each check valve comprising :

- a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with at least one orifice and transversally positioned across said conduit, said orifice defining the sole passageway of the conduit, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub ;
- means fastened to the casing, including at least one membrane and adapted to react to a differential of pressure existing between opposite faces of said membrane and to move said membrane either to an open position which allow a fluid communication from the inlet to the outlet through said orifice, or to a closed position which prevent any fluid communication from the outlet to the inlet through said orifice ;

said means including at least one membrane being, for each orifice, a nozzle comprising :

. a sleeve of the type having a longitudinal axis, at least one longitudinal outer surface, opposite ends, a conduit connecting said opposite ends and means adapted for axially setting and fastening it to seal a corresponding orifice in the partition of the casing, one end of said sleeve defining an inlet in fluid communication with duct means, the other end of said sleeve being intended to define an outlet intended to be in fluid communication with an interior of the tub,

. at least one membrane having opposite faces, made of resilient and flexible material and defining an element of sufficient size to be partly fastened to the end defining the outlet of the sleeve and to completely cover said outlet, so as when the pressure applied by water of the tub against one face of the membrane is higher than the pressure applied by the air on the opposite face of said membrane, then the unfastened portion of the membrane is moved against the end of the sleeve to completely covers said outlet (check valve closed) and prevent any fluid communication from the tub to the duct means, and when the pressure applied by the air on one face of the membrane is higher than the pressure applied by water on the opposite face of said membrane, then the unfastened portion of the membrane is moved away from the outlet (check valve open) to allow a fluid communication from the duct means to the tub and thus allow the pressurized air to bubble in water.

20. In a hydromassaging apparatus of the type comprising : a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said side walls being provided with openings below said determined level of water ; generation means adapted to generate a flow of pressurized air ; duct means positioned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ; the improvement wherein a check valve is mounted across each of said openings, each check valve comprising :

- a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with an orifice and transversally positioned across said conduit, said orifice defining the sole passageway of the conduit, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub ;
- means fastened to the casing, including at least one membrane and adapted to react to a differential of pressure existing between opposite faces of said membrane and to move said membrane either to an open position which allow a fluid communication from the inlet to the outlet through said orifice, or to a closed position which prevent any fluid communication from the outlet to the inlet through said orifice ;

said means including at least one membrane being a nozzle consisting of a sleeve made of resilient, flexible and elastic material, provided with a longitudinal axis and having two distinctive sections which integrally extends from each other along the longitudinal axis of said sleeve ;

- the first section has opposite ends, a wall connecting said ends together and defining a conduit therebetween, a longitudinal axis concentric with the longitudinal axis of said sleeve, at least one longitudinal outer surface, one end of said first section being in fluid communication with said duct means and defining an inlet to the nozzle, and means adapted for axially setting and fastening said first section to seal a corresponding orifice in the casing ;
- the second section has opposite ends, a wall having an inner surface, an outer surface and connecting said ends together to define a conduit therebetween, a longitudinal axis concentric with the longitudinal axis of said sleeve, one end of said second section being integral with the end of the first section that is opposite to the inlet of the nozzle, the other end of said second section being shaped to define opposite lips ending corresponding segment of the wall, said segments defining opposite membranes, said lips and membranes being made of resilient, flexible and elastic material, said lips being brought and kept one against the other by the elasticity of said membranes when there is no differential of pressure between opposite faces of membranes, and said other end of the second section being intended to be in fluid communication with an interior of the tub, with the proviso that when the pressure applied by water of the tub against one face of each membrane plus the force of elasticity of membranes that brought and kept lips one against the other, is higher than the pressure applied by the air on the opposite face of said membranes, then the lips of said membranes are brought and kept one against the other (check valve closed) to prevent any fluid communication from the tub to the duct means, and when the pressure applied by the air on one face of each membrane is higher than the pressure applied by water on the opposite face of said membrane plus the force of elasticity of membranes that brought and kept

lips one against the other, then said membranes and lips are disformed and lips are separated from each other to allow a fluid communication from the duct means to the tub (check valve open) and thus allow the pressurized air to bubble in water.

21. A hydromassaging apparatus according to claim 20, wherein means for axially setting and fastening the check valve to seal a corresponding opening of a side wall of a tub, consist of :

. an opening of circular cross section which defines a cylindrical surface of contact in said side wall, said cylindrical surface having a diameter ;

. a collar making an integral part with the longitudinal outer surface of the casing and being provided with an outer cylindrical surface having a diameter slighly greater than the one of the cylindrical surface of the opening ;

. a flange having opposite faces that radially extend from a portion of the outer cylindrical surface of the collar, said flange being positioned near the outlet of the casing, so that the cylindrical surface of the collar contacts the cylindrical surface of the opening and that one face of the flange contacts a side wall portion surrounding this opening.

22. A hydromassaging apparatus according to claim 21, wherein means adapted to position and fasten the sleeve inside the orifice of the casing consist of a pair of protuberance integral with said longitudinal outer surface of the first section and provided with radial faces, said radial faces being intended to contact opposite faces of the partition.

23. A hydromassaging apparatus according to claim 22, wherein the orifice is further provided with a concentric protuberance intended to pinch the outer surface of the sleeve.

24. A hydromassaging apparatus according to claim 23, wherein the lip of each membrane is bevelled in order to increase the surface of contact between said lips when the outlet of the nozzle is closed.

25. A check valve intended to be mounted across a corresponding opening of a hydromassaging apparatus of the type comprising a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said side walls being provided with openings below said determined level of water ; generation means adapted to generate a flow of pressurized air ; and duct means positioned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ; wherein said check valve comprises :

- a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with at least one orifice and transversally positioned across said conduit, said orifice defining the sole passageway of the conduit, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub,
- means fastened to the casing, including at least one membrane and adapted to react to a differential of pressure existing between opposite faces of said membrane and to move said membrane either to an open position which allow a fluid communication from the inlet to the outlet through said orifice, or to a closed position which prevent any fluid communication from the outlet to the inlet through said orifice ;

said means including at least one membrane being for each orifice, a nozzle comprising :

. a sleeve of the type having a longitudinal axis, at least one longitudinal outer surface, opposite ends, a conduit connecting said opposite ends and means adapted for axially setting and fastening it to seal a corresponding orifice in the partition of the casing, one end of said sleeve defining an inlet intended to be in fluid communication with duct means, the other end of said sleeve defining an outlet intended to be in fluid communication with an interior of the tub,

. at least one membrane having opposite faces, made of resilient and flexible material and defining an element of sufficient size to be partly fastened to the end defining the outlet of the sleeve and completely cover said outlet, so as when the pressure applied by water of the tub against one face of the membrane is higher than the pressure applied by the air on the opposite face of said membrane, then the unfastened portion of the membrane is moved against the end of the sleeve to completely covers said outlet (check valve closed) and prevent any fluid communication from the tub to the duct means, and when

the pressure applied by the air on one face of the membrane is higher than the pressure applied by water on the opposite face of said membrane, then the unfastened portion of the membrane is moved away from the outlet (check valve open) to allow a fluid communication from the duct means to the tub and thus allow the pressurized air to bubble in water.

26. A check valve intended to be mounted across a corresponding opening of a hydromassaging apparatus of the type comprising a tub having a bottom wall and side walls and being intended to be filled with water to a determined level, at least one of said side walls being provided with openings below said determined level of water ; generation means adapted to generate a flow of pressurized air ; and duct means positioned in fluid communication between said openings and generation means so that said flow can circulate from said generation means through said duct means and openings, and then bubble in water ; wherein said check valve comprises :

- a casing having opposite ends and being provided with a longitudinal axis, at least one longitudinal outer surface, an inlet at one end of said casing, said inlet intended to be in fluid communication with said duct means, an outlet at the opposite end of said casing, said outlet intended to be in fluid communication with an interior of said tub, a conduit extending from said inlet to said outlet and a partition provided with an orifice and transversally positioned across said conduit, said orifice defining the sole passageway of the conduit, said casing being further provided with means adapted for axially setting and fastening said check valve to seal a corresponding opening of the tub,
- means fastened to the casing, including at least one membrane and adapted to react to a differential of pressure existing between opposite faces of said membrane and to move it either to an open position which allow a fluid communication from the inlet to the outlet through said orifice, or to a closed position which prevent any fluid communication from the outlet to the inlet through said orifice ;

said means including at least one membrane being a nozzle consisting of a sleeve made of resilient, flexible and elastic material, provided with a longitudinal axis and having two distinctive sections which integrally extends from each other along the longitudinal axis of said sleeve ;

- the first section has opposite ends, a wall connecting said ends together and defining a conduit therebetween, a longitudinal axis concentric with the longitudinal axis of said sleeve, at least one longitudinal outer surface, one end of said first section intended to be in fluid communication with said duct means, and defining an inlet ot the nozzle and means adapted for axially setting and fastening said first section to seal a corresponding orifice in the casing ;
- the second section has opposite ends, a wall having an inner surface, an outer surface and connecting said ends together to define a conduit therebetween, a longitudinal axis concentric with the longitudinal axis of said sleeve, one end of said second section being integral with the end of the first section that is opposite to the inlet of the nozzle, the other end of said second section being shaped to define opposite lips ending corresponding segment of the wall, said segments defining opposite membranes, said lips and membrane being made of resilient, flexible and elastic material, said lips being brought and kept one against the other by the elasticity of said membranes when there is no differential of pressure between opposite faces of membranes, and said other end of the second section being intended to be in fluid communication with an interior of the tub, with the proviso that when the pressure applied by water of the tub against one face of each membrane plus the force of elasticity of membranes that brought and kept lips one against the other, is higher than the pressure applied by the air on the opposite face of said membranes, then lips of said membranes are brought and kept one against the other (check valve closed) to prevent any fluid communication from the tub to the duct means, and when the pressure applied by the air on one face of each membrane is higher than the pressure applied by water on the opposite face of said membrane plus the force of elasticity of membranes that brought and kept lips one against the other, then said membranes and lips are disformed and lips are separated from each other to allow a fluid communication from the duct means to the tub (check valve open) and thus allow the pressurized air to bubble in water.

27. A check valve according to claim 26, wherein means for axially setting and fastening the check valve to seal a corresponding opening of a side wall of a tub, consist of :

. an opening of circular cross section which defines a cylindrical surface of contact in said side wall, said cylindrical surface having a diameter ;

. a collar making an integral part with the longitudinal outer surface of the casing and being provided with an outer cylindrical surface having a diameter slighly greater than the one of the cylindrical surface of the opening ;

. a flange having opposite faces that radially extend from a portion of the outer cylindrical surface of

the collar, said flange being positioned near the outlet of the casing, so that the cylindrical surface of the collar contacts the cylindrical surface of the opening and that one face of the flange contacts a side wall portion surrounding this opening.

28. A check valve according to claim 27, wherein means adapted to position and fasten the sleeve inside the orifice of the casing consist of a pair of protuberances integral with said longitudinal outer surface of the first section and provided with radial faces, said radial faces being intended to contact opposite faces of the partition.

29. A check valve according to claim 28, wherein the orifice is further provided with a concentric protuberance intended to pinch the outer surface of the sleeve.

30. A check valve according to claim 29, wherein the lip of each membrane is bevelled in order to increase the surface of contact between said lips when the outlet is closed.

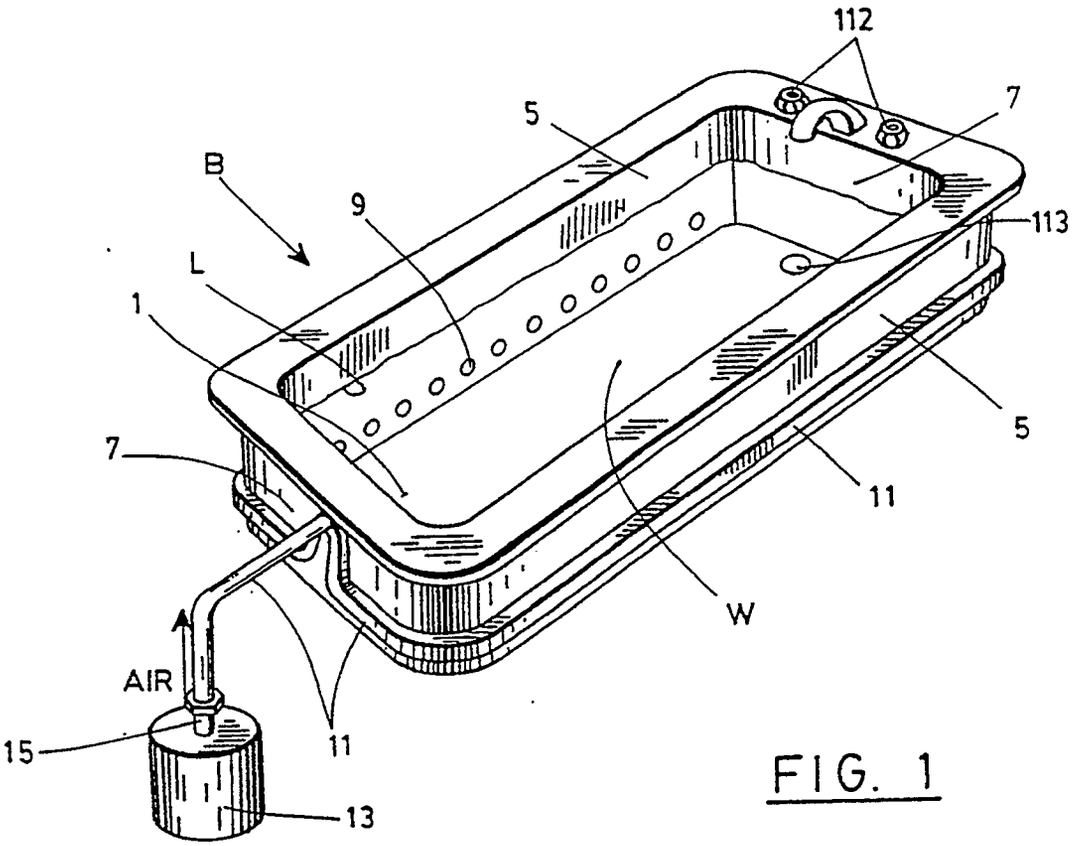

FIG. 1

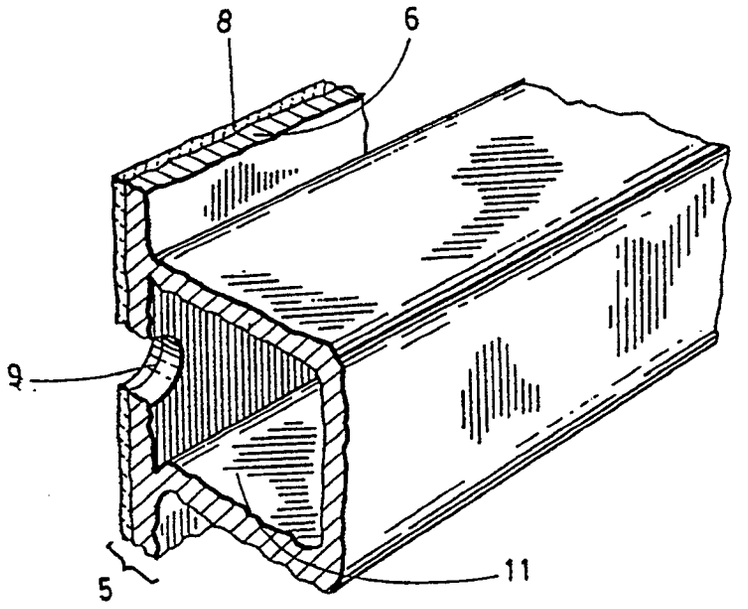

FIG. 2

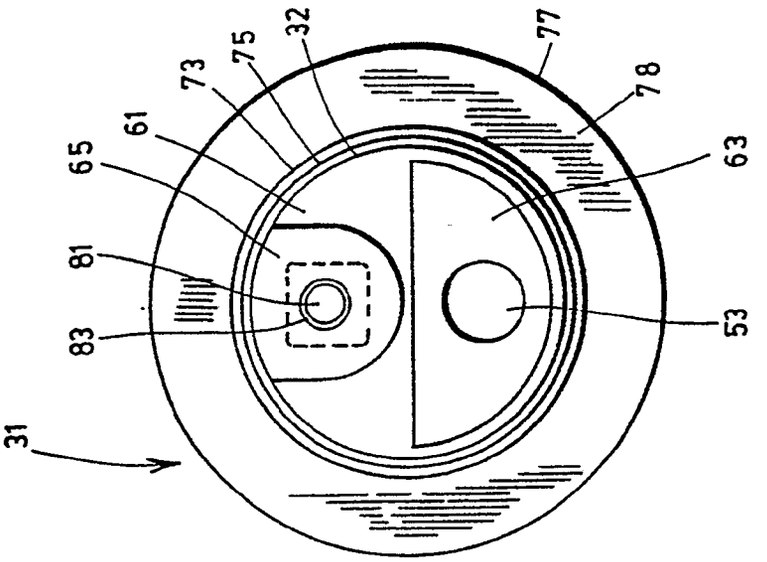

FIG. 5

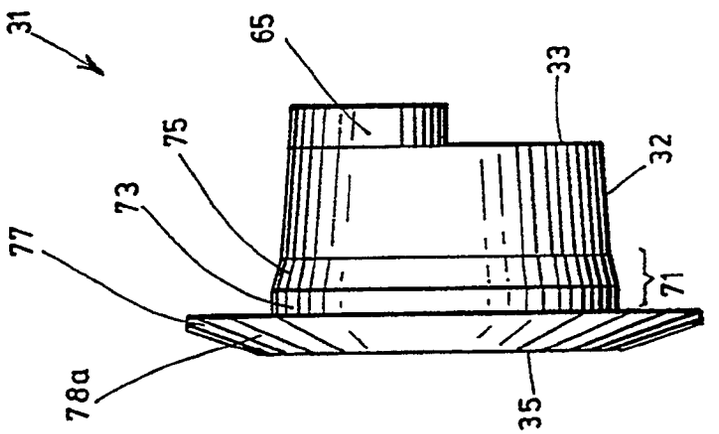

FIG. 4

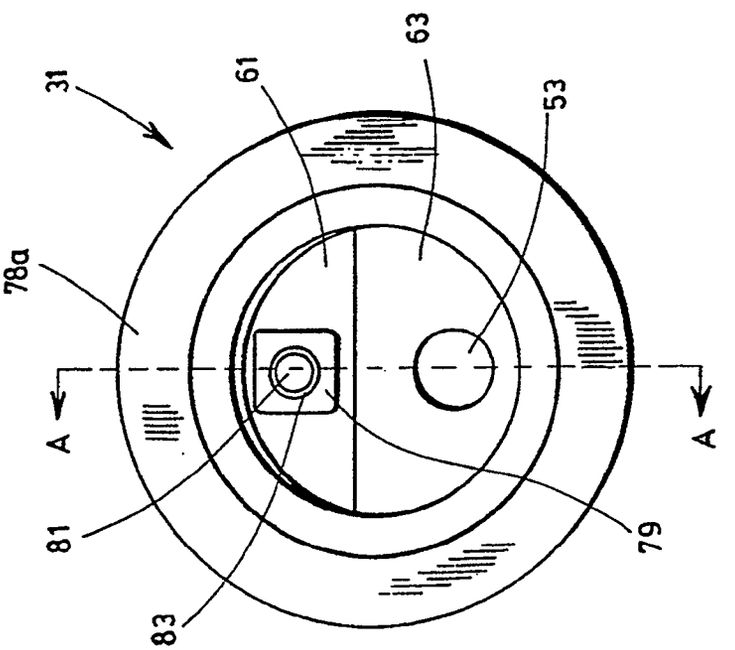

FIG. 3

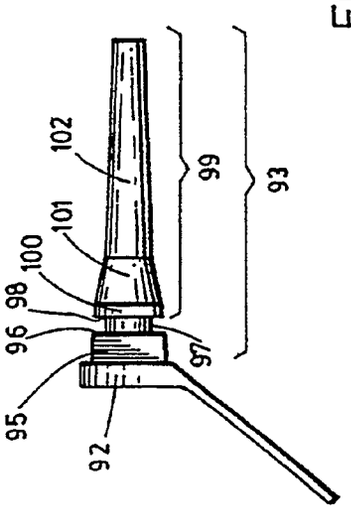

FIG. 7

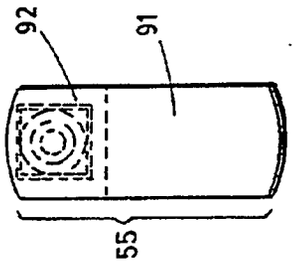

FIG. 6

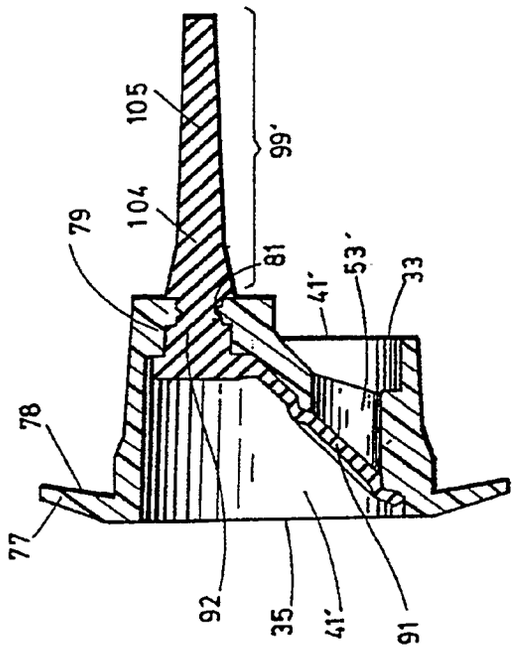

FIG. 14

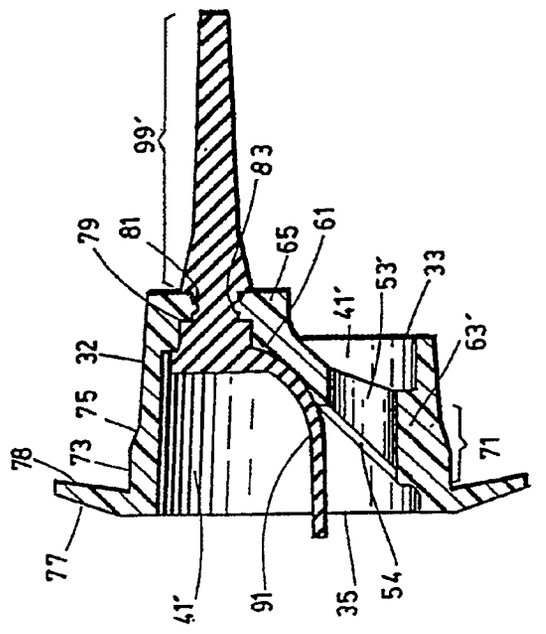

FIG. 13

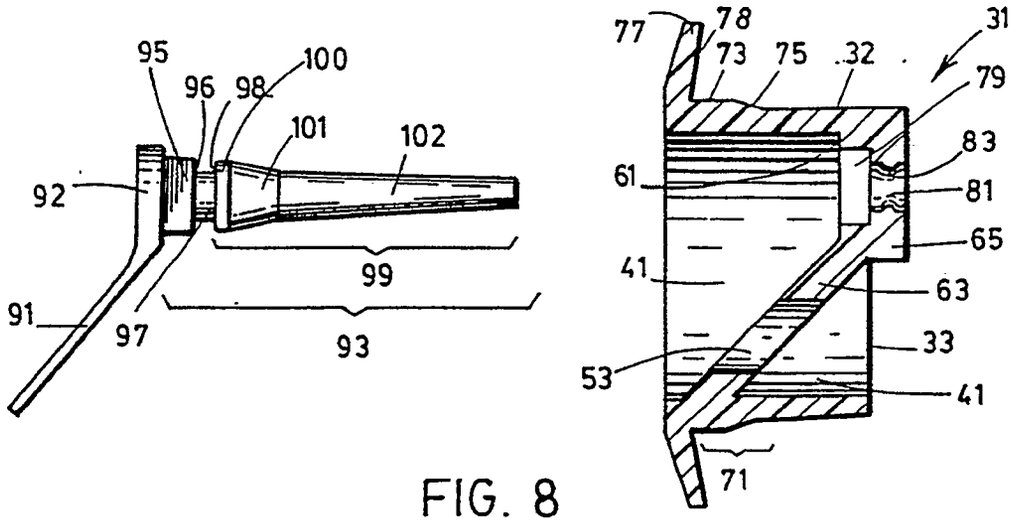

FIG. 8

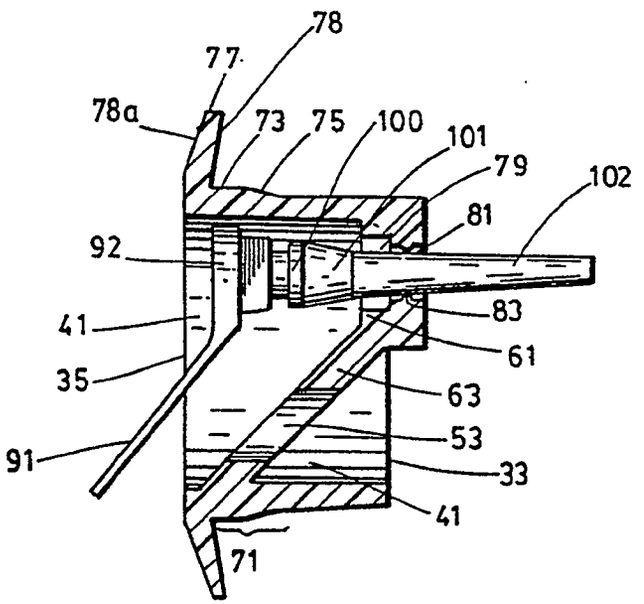

FIG. 9

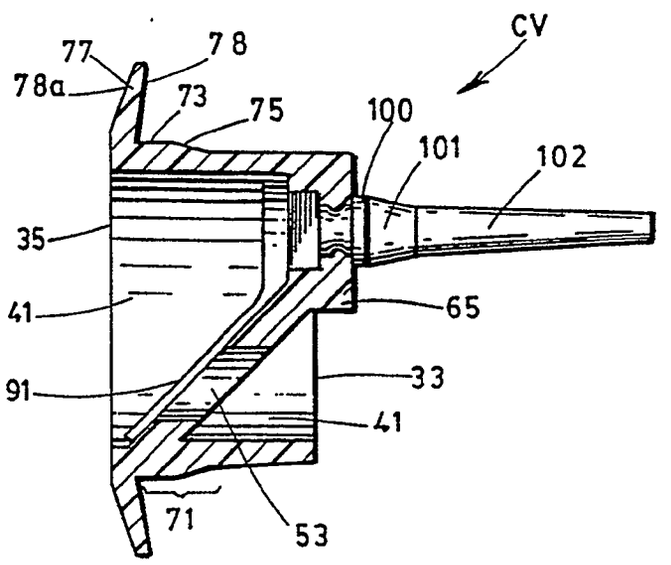

FIG. 10

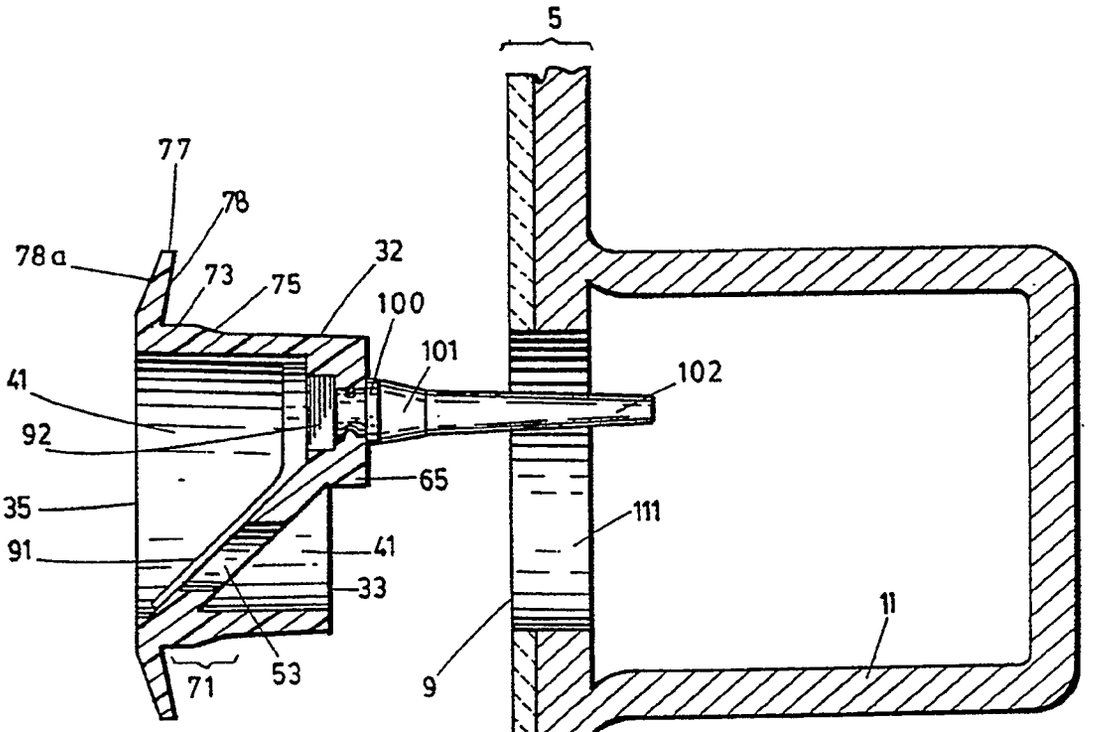
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FIG. 11

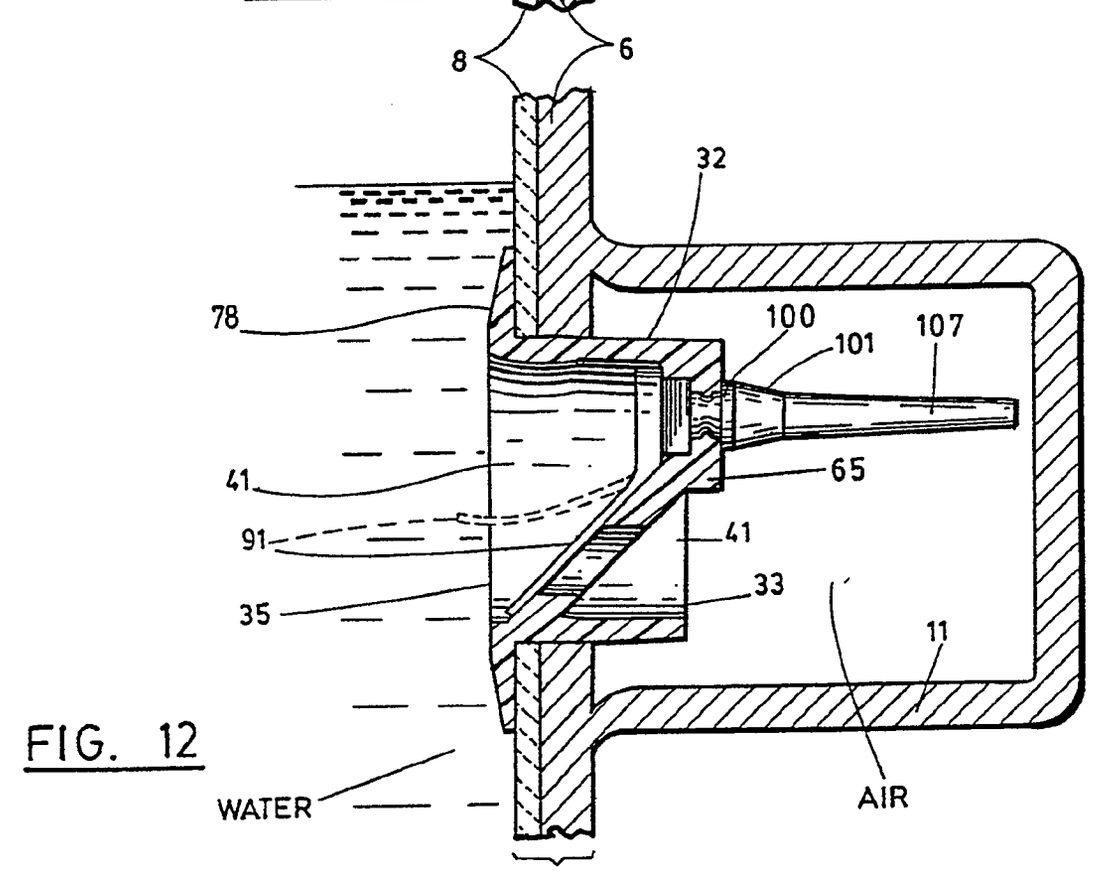
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FIG. 12

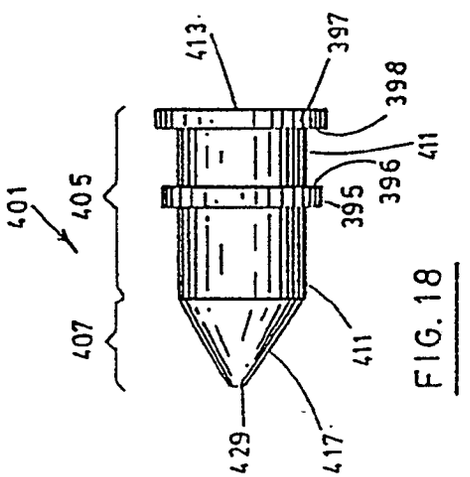

FIG. 18

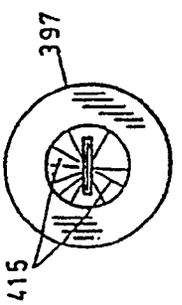

FIG. 19

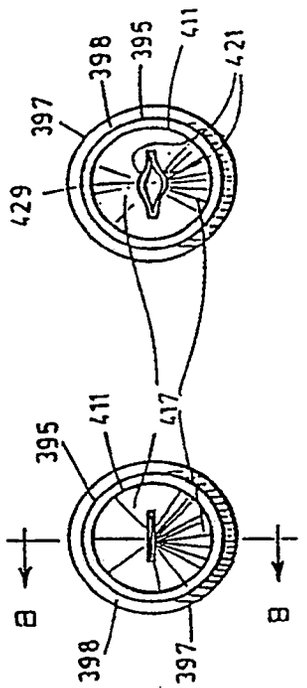

FIG. 20

FIG. 21

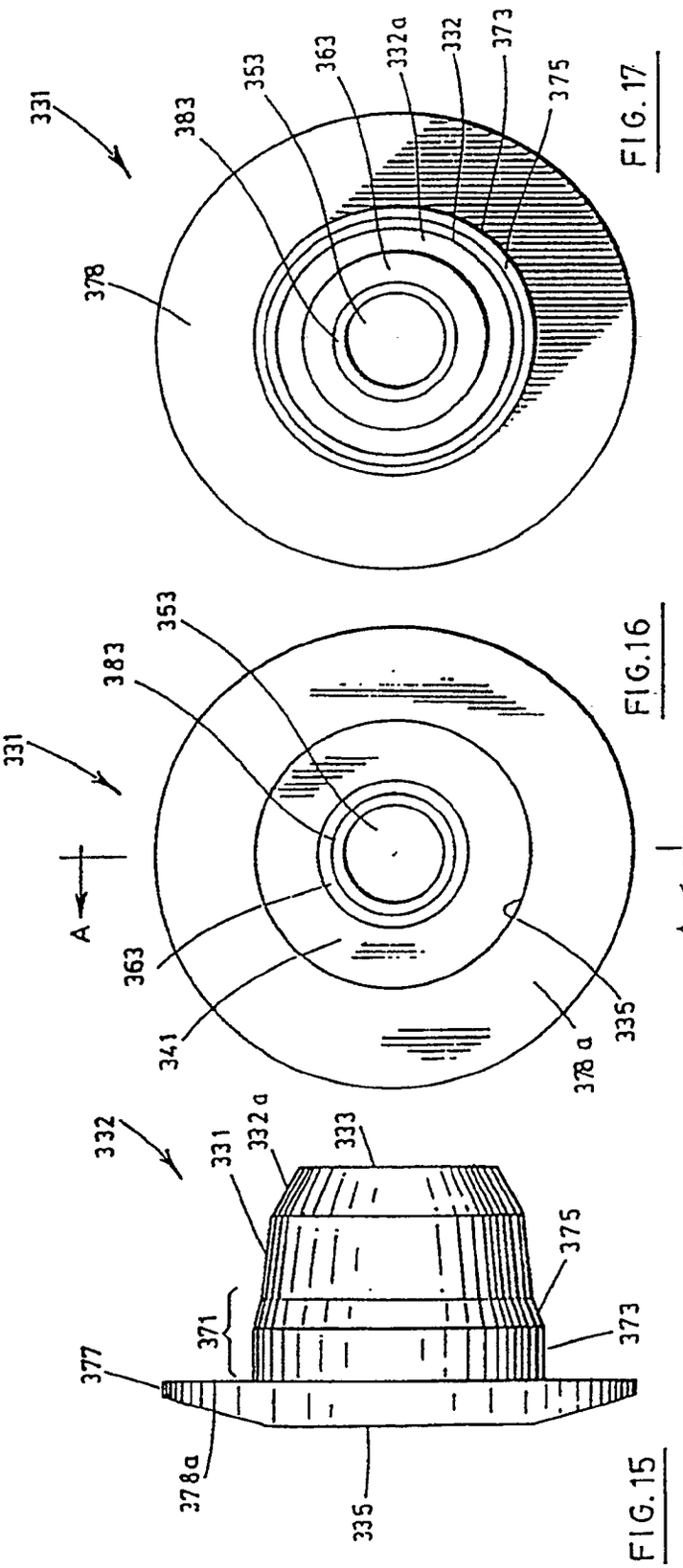

FIG. 15

FIG. 16

FIG. 17

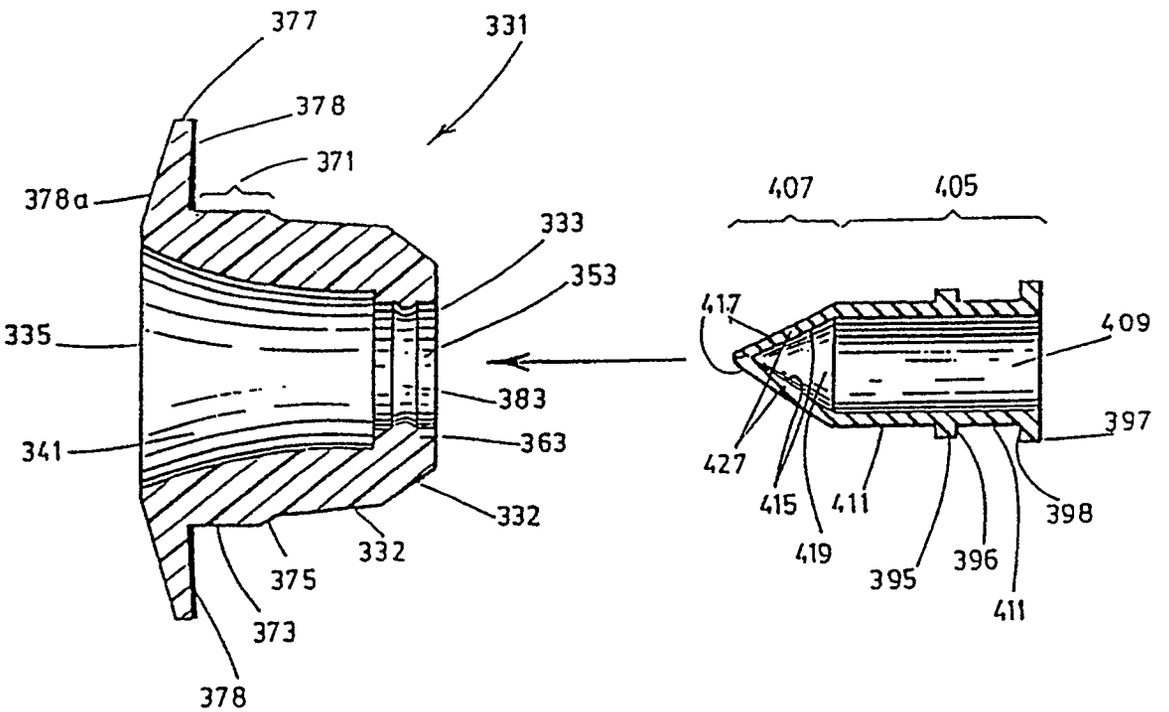
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FIG. 22

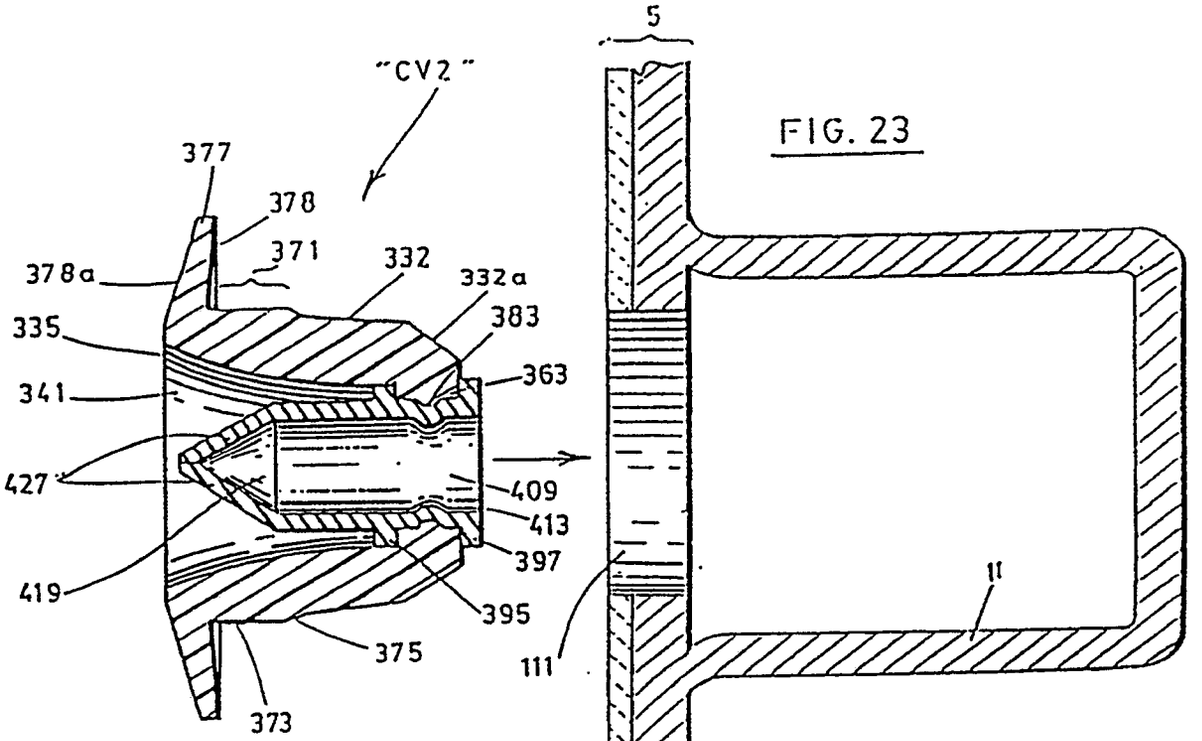
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FIG. 23

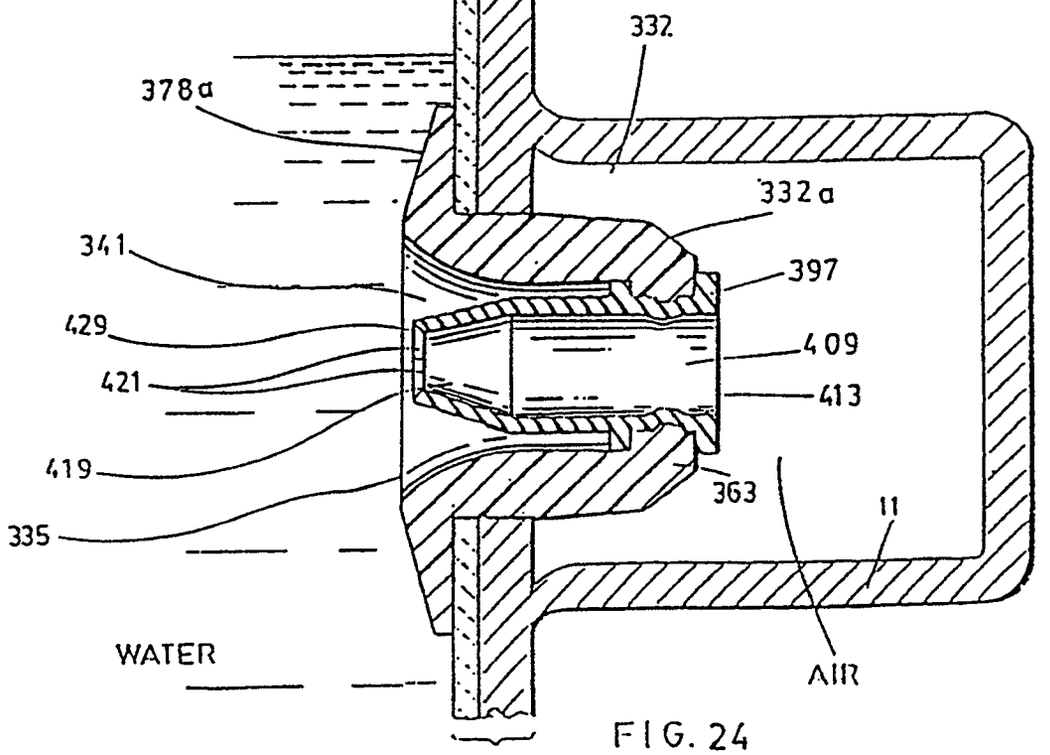
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FIG. 24