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Improved water bladder

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ABSTRACT

A bladder arrangement (13) for liquid containment and ejection wherein the elasticity of the bladder becomes the motive force for liquid ejection, the improvement which comprises a hollow, elastic, elongated tubular member having a first end (411) and second end (405), said first end having a weakened section (413) with weaker elastic strength relative to the remainder of said tubular member, said tubular member also being configured to enhance progressive expansion along the tubular member from the first end to the second end, said bladder being enclosed in a tubular housing which limits expansion both axially and longitudinally, and said bladder having an attachment on the second end of the bladder which secures the second end of said bladder and travels along the tubular housing as bladder expands until it reaches a predetermined stop.

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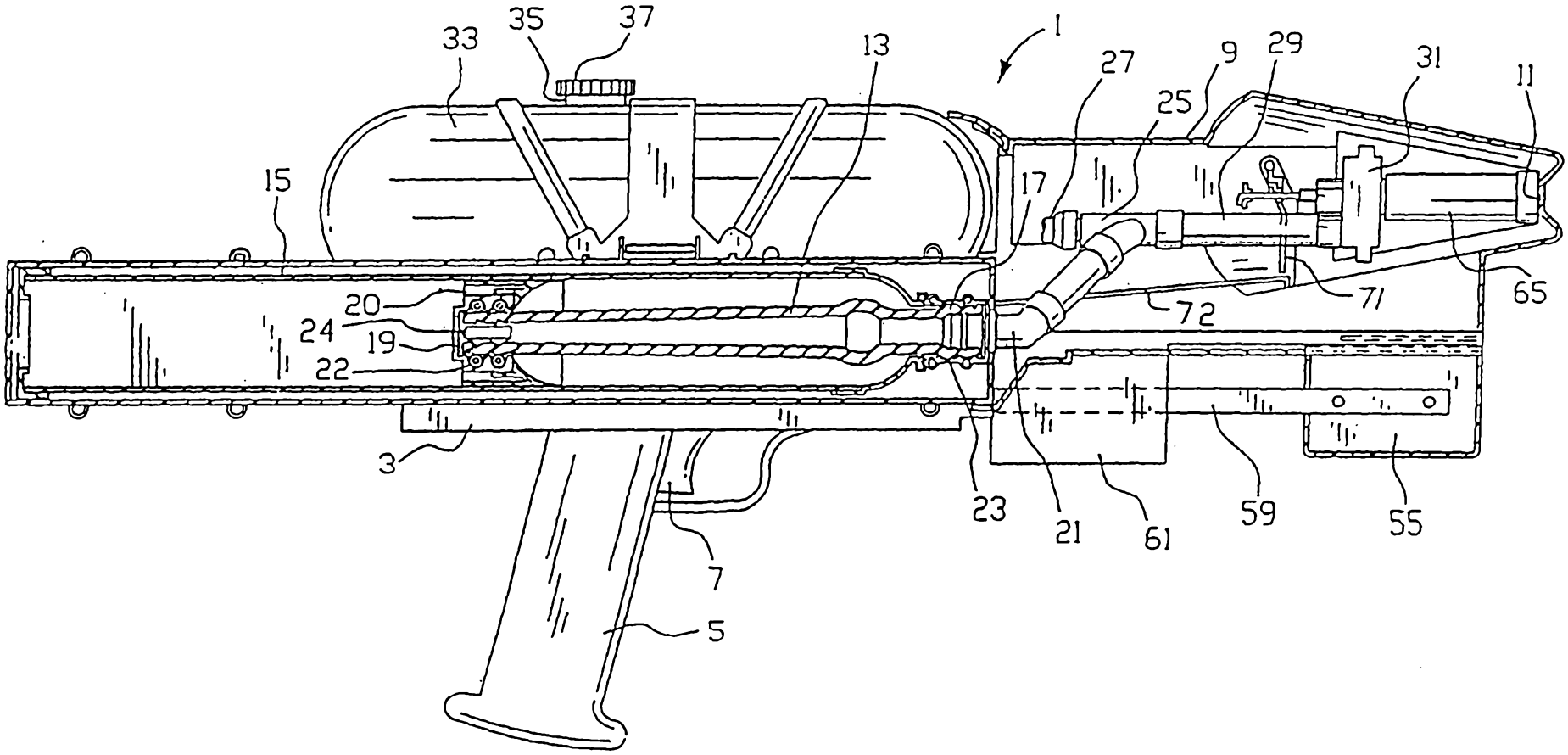

FIG. 1

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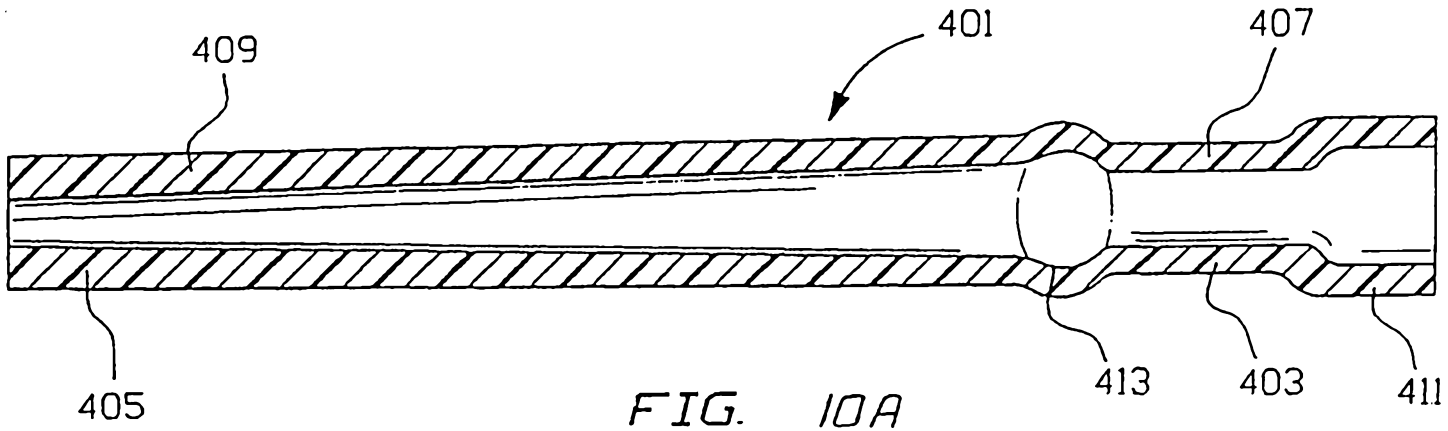

FIG. 10A

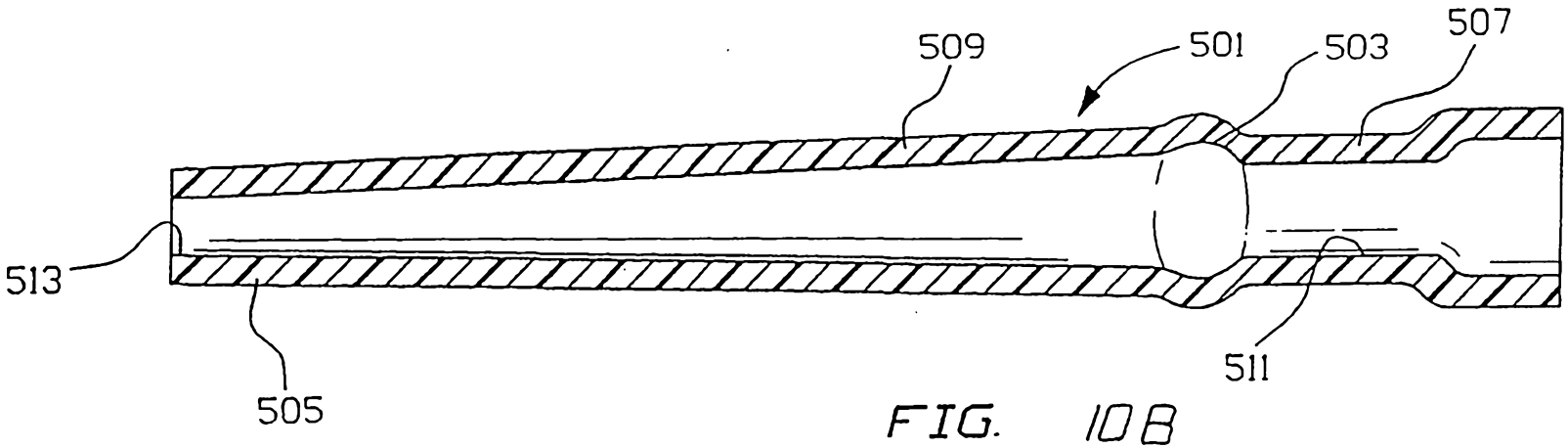

FIG. 10B

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COMPLETE SPECIFICATION
FOR A STANDARD PATENT

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Invention Title:	Improved Water Bladder

The following statement is a full description of this invention, including the best method of performing it known to us:

Improved Water Bladder

The present invention has been divided from the specification of Australian Patent Application No. AU 199735917 B2.

BACKGROUND OF THE INVENTION

The present invention provides bladders having specific features which permit controlled expansion and subsequent, predictable contraction and water ejection upon release. Such bladders are particularly suitable for toy water guns.

The following patents represent developments in bladder-containing toy guns (air and water) as well as other water guns:

United States Patent No. 5,529,525 to Deal describes a toy water bomb-mounted water gun. By the attachment of the water bomb device to a toy gun the present invention provides new functionality of the toy gun by being able to simulate a water "explosion". The water bomb device has a main housing which includes a frontward and rearward portion rotatably connected to one another and a passageway through both the frontward and rearward portions for receiving a shut off valve. The shut off valve is located within the housing and connected to both the frontward and rearward portions and adapted so that when the frontward and rearward portions are rotated relative to one another, the shut off valve is moved from an open position to a closed position. A locking mechanism releasably connects the frontward and rearward portions, such that rotation of the frontward portion relative to the rearward portion will close the shut off valve and the locking mechanism may then hold the shut off valve in its closed position until subsequently release by a trigger. An expandable bladder is filled with liquid and expends liquid when the device is activated and the shut off valve is opened.

United States Patent No. 5,373,833 to D'Andrade describes a projectile-shooting air gun. It includes a main housing which has a barrel adapted for receiving a projectile, a handle and a trigger, as well as a high pressure, inflatable bladder connected to the main housing, the bladder has an inlet and an outlet. There is also a pressurizing mechanism for providing air pressure to the bladder to inflate it. The pressurizing mechanism is physically connected to the housing and functionally connected to the bladder inlet. There is a bladder deflation valve having an upstream side and a downstream side, and it is connected to the bladder outlet at the valve's upstream side, and is connected to the trigger for opening and closing thereof, and is connected to a projectile launch tube at the valve's downstream side for launching a projectile upon deflation of at least a portion of the bladder when it has been inflated. The launch tube is located in the barrel of the main housing and connected to the downstream side of the bladder deflation valve, and adapted for receiving and shooting a projectile. In preferred embodiments, the bladder has a predetermined expansion size to which it is capable of being inflated, and an enclosure is provided around the bladder, which is a size less than the predetermined expansion size to enhance a controlled pressurization of the bladder during inflation and deflation.

United States Patent No. 5,322,191 to Johnson et al. describes a toy water gun having a housing with extended handle, a release mechanism and barrel. The water gun is connected to at least one water source external from and connected to the housing. In preferred embodiments, the water source is remote and has an indirect connection, e.g. by tubing or hosing, external of said housing and having a vent to surrounding ambient air so air may enter therethrough. Also included is a pressurized air and water storage tank external from and connectable to the housing. The pressurized tank has an orifice between said pressurized tank and said housing through which all liquids and gasses pass. There is also a pumping means for withdrawing air or water from the source or sources, and for depositing the withdrawn air or water into the pressurized tank. A plurality of one-way flow valves is included wherein at least one one-way flow valve prohibits water and air from flowing from the pressurized tank to the pumping means, at least another one said one-way flow valve prohibits water and air from flowing from the pumping means to the source or sources of air and water. There is a nozzle with a wide orifice therethrough, which is affixed to the end of said barrel, and an avenue of release connecting the nozzle to the pressurized tank. There is also a controlling means for

regulating the flow of water and air through the avenue of release, the controlling means being actuatable by a release mechanism.

United States Patent No. 5,074,437 to D'Andrade et al. is directed toward a toy water gun which is operated by selectively releasing water from a water reservoir that is pressurized with air. It is a one piece device formed in the general shape of a gun that has a manually operated air pump incorporated into the design. The air pump pressurizes a water reservoir and consequently pressurizes any water found therein. The pressurized water has an avenue of release that is regulated by the trigger mechanism of the invention. when no force is applied to the trigger, the pressurized water is held in the pressurized container with no means of release. When force is applied to the trigger, water is released from the pressurized container and is channeled through a narrow nozzle. The escape of the pressurized water through the narrow nozzle creates a stream of propelled water that lasts as long as the trigger is engaged or until the pressure of the water in the pressurized container equals ambient pressure.

United States Patent Nos. 4,991,847 and 4,890,838 to Rudell et al. both describe a timed water release toy. There is disclosed a ball having a foraminous outer shell with an inner membrane which forms an interior closure within the outer shell and with a timer and a release mechanism operative to open the inner membrane and release its contents after the time on the timer expires. The contents spill through the foraminous outer shell, wetting the player who is handling or catching the ball at the moment of release. The timer is activated and the ball is used in a game in which it is tossed between participants who seek to avoid becoming wet when the timer releases the water from the interior closure of the ball.

United States Patent No. 4,892,081 Randall Morrmann sets forth a compressible ball launcher which relies upon a telescoping cylindrical gun to compress air to force a ball out of a nozzle.

United States Patent No. 4,854,480 to Shindo describes a long range trigger-actuated squirt gun. The squirt gun includes a hollow housing in the form of a gun with a liquid dispensing assembly within the housing. The liquid dispensing assembly includes a rubber tube, expandable upon being filled with liquid, which is connected to a rigid tube with a nozzle at one end, and will dispense liquid from the rubber tube through the nozzle. A pivotable trigger is mounted with one end located to squeeze the rubber tube against the housing. A rigid coil

around the rubber tube between the trigger and rigid tube restrains the rubber tube from expansion for the length of the coil. An adapter is provided which is threadable on a faucet, for filling the rubber tube in the squirt gun with water.

United States Patent No. 4,735,239 to Salmon et al. describes a liquid projecting device. The device uses an elastic tubular bladder for receiving liquid which is expandable radially generally spherically at a local segment until a fully-expanded cross-section is achieved at which time the expanded region begins to grow axially, thereby maintaining a relatively constant pressure independent of bladder volume. The device is provided with a nozzle and a valve for controlling and directing the flow of the projected liquid.

United States Patent No. 4,458,830 to Werding describes an appliance for discharging a non-compressible liquid, creamy or pasty product under pressure. The container of rigid material comprises an appliance which employs the contractional force of an expanded rubber hose and an expanded product container for the discharge of a medium stored therein. A hollow body of elastic material located in the axis of a product container is provided with a valve at one end through which it is inflated. The shape of the inner walls for the rigid container limits a radial, diagonal-radial and axial expansion of the appliance in a predetermined ratio, whereby the medium acts upon the inflated hollow body in such a way that the volume of the latter decreases, whereby its inner pressure increases and gives it a tendency to expand. If the squeezing pressure exerted by the rubber hose and the product container upon the medium decreases, the hollow body can expand accordingly and thus compensate the loss of contraction pressure.

United States Patent No. 4,257,460 to Paranay et al. describes a water gun. The novel water gun is disclosed herein having a body formed with a central bore opening at its opposite ends to provide a discharge nozzle at one end of the body and a storage compartment or reservoir end at the opposite end of the body. The storage compartment end is adapted to releasably hold the end of an inflatable member which when loaded with water under pressure, expands so as to stretch the membrane of the inflatable storage compartment. Upon termination of the loading pressure, the inflatable member collapses under its own elasticity to discharge the stored water via the nozzle end of the body. A clamping device is employed for detachable connection gate inflatable storage compartment to its respective end of the body and a trigger

mechanism may be employed for selectively releasing the pressurized water within the storage compartment.

United States Patent No. 4,212,460 to Kraft describes a hollow water-filled game toy. The hollow body is provided having two complementary parts releasably joined about interfitting rim portions. When the parts are joined, the hollow body may be compressed to partially deform a portion of the rim structure into an opening thereby allowing the filling of water into the body interior. After deformation the parts resume their original shape. An effective hermetic seal to retain the water within the interior is formed by squeezing the body and purging water through the vents in the rim portions. The water-filled body may then be thrown against a stationary object whereby the force of impact will release the seal and allow the water to become suddenly released causing a splashing action. The complementary hollow parts may be subsequently rejoined and refilled with water to repeat the throwing and splashing action.

United States Patent No. 4,135,559 to Barnby describes a water squirt toy and fill valve combination. The water squirt toy apparatus includes a combination of a water squirt toy and a special filling valve which function together cooperatively. The water squirt-toy includes a resiliently expansible tubular member serving as a water reservoir and encased within a rigid tubular support member, and a manually operated, lever-type normally closed valve mechanism operatively associated with the expansible member for permitting or preventing fluid discharge therefrom by compressing or pinching the same. The frontward end of the expansible member is fixedly, but removably, secured to a discharge opening. The filling valve is particularly structured for fluidically mating with a conventional hose bib or hose as well as with the discharge opening in order to permit easy and rapid filling and refilling of the expansible member with water. The discharge opening may also mate directly with the hose bib or hose without the special valve. An injector is also provided for operative connection to the filling valve for injecting chemicals in to the water supply whereby the discharged streams will coalesce and exhibit reduced separation so as to be discharged over significantly greater distances; and amusement apparatus which is particularly adaptable for use with the water squirt toy is also disclosed. A weakened annular portion of the tubular member is utilized to insure that the expansion begins frontward and progresses rearwardly.

United States Patent No. 3,486,539 to Candido Jacuzzi describes a liquid dispensing and metering assembly. The liquid dispensing and metering assembly in which an expansible receptacle of a material adapted to maintain constant pressure characteristics over a substantial change in volume of liquid content of such receptacle, discharges through a slow rate metering-element to provide a uniform discharge flow at a low constant pressure.

United States Patent No. 2,237,678 issued to Raymond Lohr et al describes a repeating, cork shooting toy which ulitizes a cork magazine which rotates after each firing to position the next cork in sequence for firing.

Notwithstanding the foregoing, the prior art neither teaches nor suggests the use of an expanded bladder, pumped up by a pump on a toy water gun from a tank, to release water, as in the present invention nor the use of the unique bladders in water guns, or ejection nozzle for consistent flow as in the present invention.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided an improved bladder arrangement for liquid containment and ejection wherein the elasticity of the bladder becomes the motive force for liquid ejection, the improvement which comprises:

a hollow, elastic, elongated tubular member having a first end and second end, said first end having a weakened section with weaker elastic strength relative to the remainder of said tubular member, said tubular member also being configured to enhance progressive expansion along the tubular member from the first end to the second end, said bladder being enclosed in a tubular housing which limits expansion both axially and longitudinally, and said bladder having an attachment on the second end of the bladder which secures the second end of said bladder and travels along the tubular housing as bladder expands until it reaches a predetermined stop.

According to another aspect of the present invention there is provided an improved bladder for liquid containment and ejection wherein the elasticity of the bladder becomes the motive force for liquid ejection, the improvement which comprises:

a hollow, elastic elongated tubular member having a first end and a second end, said first end having a section of weakened elastic strength relative to the remainder of said tubular member, said weakened section having a larger diameter than the remaining said tubular member, and said tubular member also having a variable diameter from larger at the first end to smaller at the second end in a taper and with a

constant wall thickness, thus enhancing expansion at the larger diameter first and then enhancing progressive expansion from the first end to the second end.

According to yet another aspect of the present invention there is provided a toy water gun having an expandable bladder for containment of water and ejection of water and ejection of water therefrom, wherein the expanded bladder becomes the motive force for the ejection of the water, the improvement which comprises:

(a) a bladder housing connected to said water gun having a bladder therein, wherein said bladder has a predetermined expansion size to which it is capable of being expanded and said bladder housing encloses said bladder such that said bladder housing has a size less than predetermined expansion size; and

(b) wherein said bladder comprises a hollow, elastic, elongated tubular member having a first end and second end, said first end having a weakened section with weaker elastic strength relative to the remainder of said tubular member, said weakened section having a thinner wall than the remainder of said tubular member, said tubular member also having a variable thickness of the wall from thinner to thicker along the length of said tubular member, said first end being thinner and said second end being thicker thus, enhancing expansion at the thinner wall section and enhancing progressive expansion along the tubular member to the second end thicker wall.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is more fully understood when the present specification is taken in conjunction with the drawings appended hereto, wherein:

Figure 1 shows a side cut view of a present invention toy water gun;

Figure 2 shows a partial side cut view of the present invention toy water gun shown in Figure 1 with the bladder removed for presentation of the pump;

Figure 3 shows a side cut view of a bladder release valve which may be used in the present invention toy water gun;

Figures 4 through 6 show partial side cut views of an enclosure and bladder for a present invention toy water gun wherein the bladder is shown in various expansion stages;

Figure 7 shows a side cut view of an alternative embodiment present invention toy water shotgun;

Figure 8 shows a partial, bottom cut view of the present invention toy water gun shown in Figure 7 with the bladder removed for presentation of the pump valve arrangement;

Figure 9 shows a side cut view of a bladder release valve of the present invention toy water shotgun shown in Figures 7 and 8;

Figure 10A shows a side cut view of an embodiment of a present invention bladder, which relies upon increasing wall thickness;

Figure 10B shows a side cut view of another embodiment of a present invention bladder which relies upon variable diameter;

Figure 11 illustrates a side cut view of a present invention illustrating one embodiment showing a turbulence control member;

Figure 12 shows a front view of the nozzle shown in Figure 11;

Figure 13 shows a front cut view of the turbulence control member shown in Figure 11;

Figure 14 shows an oblique view of an alternative turbulence control member for present invention toy water gun having internal linear stream guidance walls;

Figure 15 shows a front view of another alternative embodiment turbulence control member with a plurality of fins having a predetermined geometric pattern; and,

Figure 16 shows an oblique view of yet another alternative embodiment turbulence control member having external linear stream guidance walls.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

The present invention toy water gun has been developed to provide high powered, safe shooting of water, while being fully self-contained, i.e. without the need for pressurized gas canisters or batteries or external pressurizing means such as pressurized water from a garden hose or faucet. The toy water gun of the present invention also provides relatively constant pressure throughout the duration of the shot. It relies upon manual pumping to fill a bladder with water which will store the water under pressure created by elastic bladder expansion for subsequent firing. In some preferred embodiments, a significantly large nozzle opening is provided to achieve the aforesaid shotgun effect. This nozzle can have an extremely large diameter compared to all prior known water guns, the diameter being about 1 cm (three eighths of an inch) or larger.

Referring now to Figure 1, the operation of the present invention embodiment can best be explained. Figure 1 is a side view of the present invention embodiment toy water gun 1 with main housing 3, handle 5, and barrel 9 with nozzle 11.

Bladder 13 is located within enclosure 15. Bladder 13 has a front end 17 and back end 19 and is cylindrical, but could be of another shape and not exceed the scope of the present invention. Front end 17 acts both as an inlet and an outlet in this embodiment, but the water gun could be configured so the back end acts as the outlet or vice versa. Back end 19 includes clamp 22 and also includes bladder carriage 20 surrounding clamp 22. Clamp 22 holds plug 24 in the back end 19 of bladder 13 and connects back end 19 of bladder 13 to bladder carriage 20. Bladder carriage 20 moves towards the back of the gun as the bladder 13 is expanded (filled) and moves back to its rest position (shown in Figure 1) during release of the bladder. Front end 17 has tube 21 connected thereto via clamp 23. Tube 21 is connected to a "y" connection 25 which is connected to tube 27, which is connected to a pump, described below. Connection 25 is also connected to tube 29 which is connected to a bladder release valve 31, discussed below.

The operation of present invention toy water gun 1 is illustrated by reference to both Figures 1 and 2 simultaneously, with identical parts for both figures being identically numbered. Figure 2 shows a partial side cut view, with the bladder 13 and related housing removed to show pump 45 and its operation. Toy water gun 1 is operated by filling or partially filling tank 33 with water through fill port 35 after removal of cap 37. Tank 33, as shown, is connected to water gun main housing 3, as shown. By "connected" is meant physically or fluidly connected to the gun directly or indirectly or internally contained therein or integrally formed therewith. Cap 37 has a small vent hole (not shown) to allow air entry but to discourage water leakage to prevent a vacuum from being formed in tank 33. Tank-to-pump tube 39 is connected to pump 45 and includes one-way valve 41 which permits water to enter into pump cylinder 47, but not back into tank 33. Movement of the piston 57 within the pump cylinder 47 forces movement of water to bladder 13 from tank 33. The piston 57 is operated by the pump rod 59 that connects the piston 57 to the slider handle 55. The pump rod 59 is anchored to the slider handle 55 and is slidably held in place by block 61.

The slider handle 55 is operated manually by the user. The user holds the slider handle 55 with one hand and the gun handle 5 with the other. The slider handle 55 is then moved

back and forth along the length of its path, with block 61 acting as a stop. The back and forth action is transferred to the piston 57, which draws water from tank 33 through tubing 39 and past one-way flow valve 41, into cylinder 47 on the outward stroke. On the inward stroke, water in cylinder 47 is forced (or pumped) through tubing 27, through "y" connection 25, into tubing 21 and into the bladder 13 for expansion and filling thereof. Water is pumped to the bladder 13 via pump 45 until the bladder 13 is filled. Water will also enter tube 29, but will not eject through the outlet tubing 65 and nozzle 11 because release valve 31 will be closed until trigger 7 is pulled. Once under expansion, the water in bladder 13 is prevented from flowing freely through the outlet tubing 65 by valve 31.

Referring now to Figure 3, taken in conjunction with Figures 1 and 2 with identical parts being identically numbered, details of release valve 31 are shown in a side cut view. Linkage trigger riser 71 is connected to trigger 7 via linkage 72 (Figures 1 and 2) and is slidably attached to pull rod 73. Spring 75 and stop 77 work in conjunction with trigger riser 71. Stop 77 is securely attached to pull rod 73. Pull rod 73 has at its opposite end a flexible connection universal ball connector 83. This is slightly rotatable within valve plug 84. When the trigger 7 is pulled, linkage 72 causes trigger riser 71 to compress spring 75 to the left and pushes on stop 77 to move pull rod 73 and valve plug 84 with valve seal 85 to the left. However, spring 79 and water pressure within chamber 86 apply forces which tend to maintain valve plug 84 and valve seal 85 in the closed, sealed position. When sufficient squeeze pressure is applied to the trigger, spring 75 pushes stop 77 to the left, thereby, valve plug 84 and valve seal 85 are snapped to the left for rapid release and ejection of water motivated by compressive forces of the water-filled bladder 13. This creates the desired blasting effect and enhances the rate and distance of the ejected water.

Figures 4 through 6 show side, partially cut, simplified views of a present invention toy water gun bladder 13 in various states of expansion. In this preferred embodiment arrangement, the bladder 13 has a predetermined inflated size and enclosure 15 has a size less than that predetermined fully expanded size.

In Figure 4, bladder 13 is shown in its rest (unfilled, unexpanded) position, with identical parts being identically numbered, but with more bladder 13 detail shown. The bladder 13 includes a preformed "bubble" portion 91, which is weaker than the rest of the bladder and

thus enhances expansion at that location. The bladder 13 preferably includes wall 93 which is tapered in the unexpanded state, with the wall having a smaller diameter towards back end 19 and a larger diameter towards bubble 91 and front end 17. The smaller diameter section requires more pressure to expand than the larger diameter section. Thus, expansion starts at the bubble 91 and progresses towards the back end 19. The bladder 13 first expands radially and then expands longitudinally to provide a more constant rate of flow when released.

Enclosure 15 acts as a bladder guide and limits expansion of the bladder 13 to prevent bursting and to support water weight. The enclosure 15 may be described relative to air pressurization of the bladder. For example, in the preferred embodiment, the bladder 15's uninflated diameter may be approximately 1.9 cm (three quarters of an inch), and fully inflated with 25 psig, it may have a diameter of approximately 10.1 cm (four inches). The total size or volume of the bladder is based on the bladder length. Enclosure 15 may have a diameter of, for example, approximately 8.9 cm (three and one half inches). This enclosure restricts over expansion and helps to cause expansion and release to occur with consistency. Thus, in Figure 4, bladder 13 is at rest. In Figure 5, there is water pressure applied to cause initial expansion. This is created by the force of pump 45 pushing water into the bladder 13. First, bubble 91 is expanded as bubble 91', shown in Figure 5, and expansion occurs first at the outlet end 17 and does so radially. Next, as more water is added, the bladder 13 will expand laterally down the enclosure 15 at a fixed pressure, and rate, as shown as expanded portion 91" in Figure 6. Likewise, the contraction of the bladder 13 will cause the release of water, and at a relatively constant pressure for a constant rate of ejection will be achieved.

Figure 7 is a side view of another embodiment of a toy water gun 101 in accordance with the present invention. The toy water gun 101 is similar to the first embodiment and includes main housing 103, handle 105, trigger 107 and barrel 109 with nozzle 111. In this embodiment, nozzle 111 is circular and has an opening of about 1.1 cm (seven sixteenths of an inch) in diameter.

Bladder 113 is located within enclosure 115. Bladder 113 has a front end 117 and back end 119 and is generally cylindrical, but could be of another shape and not exceed the scope of the present invention. Front end 117 acts both as an inlet and an outlet in this embodiment, but the water gun could be configured so that back end 119 acts as the outlet or vice versa. Back

end 119 includes clamp 122 which holds plug 124 in the back end 119 of bladder 113, and also includes bladder carriage 120 surrounding and connected to clamp 122. Bladder carriage 120 moves towards the back of the gun as bladder 113 is expanded (filled) and moves back to its rest position (shown in Figure 7) during release of the bladder. Front end 117 has tube 121 connected thereto via clamp 123. Tube 121 is connected to chamber 125 which is connected to tube 127, which is connected to a pump, described below. Chamber 125 is also connected to and contains a bladder release valve 131, discussed below.

The operation of present invention toy water gun 101 is illustrated by reference to both Figures 7 and 8 simultaneously, with identical parts for both figures being identically numbered. Figure 8 shows a partial, cut, bottom view, with the bladder 113 and related housing removed to show pump not in Figure 7 or 8 and valving arrangement. Toy water gun 101 is operated by filling or partially-filling tank 133 with water through fill port 135 after removal of cap 137. Cap 137 has a small vent hole (not shown) to allow air entry but to discourage water leakage to prevent a vacuum from being formed in tank 133. Tank-to-pump tube 139 is connected to pump 145 and includes one-way valve 141 which permits water to be drawn into pump cylinder 147, but not back into tank 133. Movement of the piston 158 within the pump cylinder 147 permits movement of water to bladder 113 from tank 133. The piston 158 is operated by the pump rod 159 that connects the piston 158 to the slider handle 155. The slider handle 155 is operated manually by the user. The user holds the slider handle 155 with one hand and the gun handle 105 or the top handle 167 with the other. The slider handle 155 is then moved back and forth along the length of its path. The back and forth action is transferred to the piston 158, which draws water from tank 133 through tubing 139 and past one-way flow valve 141, into cylinder 147 on the outward stroke. On the inward stroke, water in cylinder 147 is forced past one-way valve 144 and into chamber 125, into tubing 121 and into the bladder 113 for expansion and filling thereof. Water will not eject through nozzle ill because release valve 131 will be closed until trigger 107 is pulled. Water is pumped to the bladder 113 via pump 145 until the bladder 113 is filled.

Pressure release valve 146 prevents over pumping to bladder 113 by opening and allowing water to pass from the pump 145 back to the tubing 139 and the tank 133 once a

predetermined pressure is achieved. Once under expansion, the water in bladder 113 is prevented from flowing freely through the outlet tubing 165 to nozzle 111 by valve 131.

Referring now to Figure 9, taken in conjunction with Figures 7 and 8 with identical parts being identically numbered, details of chamber 125 with release valve 131 are shown in a side cut view. Linkage trigger riser 171 is connected to trigger 107 via linkage 172 (Figure 7) and is slidably attached to pull rod 173. Spring 175 and stop 177 work in conjunction with trigger riser 171. Stop 177 is permanently attached to pull rod 173. Pull rod 173 has at its opposite end a flexible connection universal ball connector 183. This is slightly rotatable within valve plug 184. When the trigger 107 is pulled, trigger riser 171 compresses spring 175 to the left and pushes stop 177 to move pull rod 173 and valve plug 184 with valve seal 185. When sufficient squeeze pressure is applied to the trigger, spring 175 pushes stop 177 to the left, thereby, valve plug 184 and valve seal 185 and are snapped to the left for rapid release and ejection of water motivated by compressive forces of the water-filled bladder 113. This creates the desired blasting effect and enhances the rate and distance of the ejected water. In some embodiments, the springs 175 and 179 are balanced so that once valve seal 185 is opened, it does not close until the internal pressure is close to zero. This maintains a single, quick, shotgun blast.

It should now be recognized that preferred embodiments toy water guns of the present invention having the enclosure about the bladder, will allow for repeat shots with the same burst of water and thus consistency in firing, until the bladder is substantially fully deflated.

Figure 10A illustrates another embodiment of a bladder 401 in accordance with the present invention which is a hollow tubular member 403. It has a first end 411 and a second end 405. Located in the area of first end 411 is a weakened section 413. Here, weakened section 413 is in the general shape of a bubble, but could be otherwise shaped without exceeding the scope of the invention, e.g. an enlarged elongated or ovoid shape. This is the starting or initiating expansion point described in conjunction with Figure 4 above. Also, the tubular member 403 has a unique shape developed to encourage expansion, first, radially at weakened section 413, and then lengthwise from right to left (from first end 411 to second end 405). In this embodiment, bladder 401 has a thicker wall 409 at second end 405 and a thinner wall 407 at first end 411. First end 411 also has an expanded neck, as shown, for fitting over an inlet/outlet tube and, when attached as such, has no bearing on the foregoing.

Figure 10B shows another alternative bladder 501, with weakened section 503, first end 507 and second end 505. Here, tubular member 509 has a tapered (variable) diameter with a larger diameter 511 at first end 507 and a smaller diameter 513 at second end 505. Combinations of variable wall thicknesses shown in Figure 10A and variable diameters shown in Figure 10B may alternatively be used.

Figure 11 shows a partial side cut view of the water gun 1 with the main aspects of the water gun not shown except for a barrel and nozzle. While the barrel and nozzle are preferably used with the water gun 1 described above, it will be recognized by the skilled artisan from the present disclosure that the barrel and nozzle can be used in conjunction with any standard water gun. These would include pump up water guns such as is described in the information disclosure statement above, bladder water guns, reciprocal firing water guns, and any other water guns which are or may be available.

Also shown in Figure 11 is the outlet tube 65, which may be located within the barrel of a toy water gun, or may comprise the barrel of any toy water gun, as noted above, with large diameter nozzle 11 contained in nozzle cover 209. The outlet tube 65 or barrel has a front section 211 which is specifically designed to receive a turbulence control member 213. Turbulence control member 213 is shown in its cut side view and has a bundle of tubes such as tubes 215, 217, and 219 which run parallel to the elongated length of outlet tube 65 and act as linear stream guidance walls. This enhances laminar flow ejection of water through nozzle 11. Further enhancement is achieved by the optional use of screens such as screen 221 placed against the rearward end of turbulence control member 213, screen 223 placed against the front end of turbulence control member 213, and screen 225 spaced away from screen 223 in front of turbulence control member 213 and against nozzle cover 209, as shown.

Figure 12 shows a front view of the nozzle shown in Figure 11. Nozzle 11 contained in nozzle cover 209 reveals behind it screen 225, as shown.

Referring now to Figure 13, there is shown an enlarged cross-sectional view of the turbulence control member 213 shown in Figure 11. Thus, turbulence control member 213 has an outer hollow tube 214 and contains a plurality of hollow, elongated, parallel tubes such as tubes 215, 217, and 219.

Referring now to Figure 14, there is shown another embodiment of a turbulence control member 251. This is unistructurally formed and includes a flanged front section 253 which may include a nozzle orifice or may be placed within a similarly structured barrel to that described in connection with the first nozzle embodiment with a nozzle cover located in front of it. Additionally, optional screens may be included in front of, behind, or both in front of and behind turbulence control member 251. Elongated portion 255 has been formed with a plurality of linear stream guidance walls such as walls 257, 259, and 261, along with others, as shown. These linear stream guidance walls project radially inwardly and run parallel to an imaginary central axis for maximum turbulence control.

While the linear stream guidance walls shown in Figure 14 are linear and project inwardly toward a central axis, and the linear stream guidance walls of Figure 13 are comprised of tubes, any reasonable geometry will aid in turbulence control as long as the linear stream guidance walls generally run substantially parallel to the central axis of the barrel to settle the flow of liquid to substantially reduce turbulence. This permits a more laminar slug of water to exit the nozzle, which in turn keeps the water together for a longer shooting distance. Thus, the particular geometry selected may now come within the purview of the artisan.

For example, Figure 15 illustrates a front view of a turbulence control member 271 with a plurality of fins acting as linear stream guidance walls. It includes an elongated outer tube 273 and parallel fins represented by fins 275 and 277 and fins arranged at right angles thereto shown as fins 279 and 281. These fins all run parallel to the elongated outer tube 273.

Likewise, Figure 16 shows turbulence control member 291 which may be unistructurally formed and has a central core 293 with outwardly extending radial fins such as fins 295 and 297, as shown.

The Figure is exaggerated with regard to the thickness of central core 293 and turbulence control member 291 may ideally be unistructurally formed and may optionally be used with one or more screens and inserted into a water gun barrel in proximity to the nozzle.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An improved bladder arrangement for liquid containment and ejection wherein the elasticity of the bladder becomes the motive force for liquid ejection, the improvement which comprises:

a hollow, elastic, elongated tubular member having a first end and second end, said first end having a weakened section with weaker elastic strength relative to the remainder of said tubular member, said tubular member also being configured to enhance progressive expansion along the tubular member from the first end to the second end, said bladder being enclosed in a tubular housing which limits expansion both axially and longitudinally, and said bladder having an attachment on the second end of the bladder which secures the second end of said bladder and travels along the tubular housing as bladder expands until it reaches a predetermined stop.

2. The bladder of Claim 1 wherein said weakened section is a bubble shape.

3. The bladder of Claim 1 wherein the elasticity of said tubular member is such that it expands radially first and then longitudinally.

4. The bladder of Claim 1 wherein said first end has an end portion which has an enlarged diameter relative to the remainder of said tubular member for attachment to an inlet-outlet tube.

5. The bladder of Claim 1 wherein the bladder is tapered from the first end to the second end.

6. An improved bladder for liquid containment and ejection wherein the elasticity of the bladder becomes the motive force for liquid ejection, the improvement which comprises:

a hollow, elastic elongated tubular member having a first end and a second end, said first end having a section of weakened elastic strength relative to the remainder of said tubular member, said weakened section having a larger diameter than the remaining said tubular member, and said tubular member also having a

variable diameter from larger at the first end to smaller at the second end in a taper and with a constant wall thickness, thus enhancing expansion at the larger diameter first and then enhancing progressive expansion from the first end to the second end.

7. The bladder of Claim 6 wherein the initial weaker section includes a bubble shape.

8. The bladder of Claim 6 wherein the elasticity of the material is such that it expands radially first and then longitudinally.

9. The bladder of Claim 8 wherein said is enclosed in a tubular housing which limits expansion both axially and longitudinally.

10. The bladder of Claim 7 wherein said bladder has an attachment to the end of the bladder which secures the second end of said bladder and said attachment travels longitudinally along said tubular housing as bladder expands and until it reaches a predetermined stop.

11. The bladder of Claim 6 wherein said first end has an end portion which has an enlarged diameter relative to the remainder of said tubular member for attachment to an inlet/outlet tube.

12. In a toy water gun having an expandable bladder for containment of water and ejection of water and ejection of water therefrom, wherein the expanded bladder becomes the motive force for the ejection of the water, the improvement which comprises:

(b) a bladder housing connected to said water gun having a bladder therein, wherein said bladder has a predetermined expansion size to which it is capable of being expanded and said bladder housing encloses said bladder such that said bladder housing has a size less than predetermined expansion size; and

(c) wherein said bladder comprises a hollow, elastic, elongated tubular member having a first end and second end, said first end having a weakened section with weaker elastic strength relative to the remainder of said tubular member,

said weakened section having a thinner wall than the remainder of said tubular member, said tubular member also having a variable thickness of the wall from thinner to thicker along the length of said tubular member, said first end being thinner and said second end being thicker thus, enhancing expansion at the thinner wall section and enhancing progressive expansion along the tubular member to the second end thicker wall.

13. The toy water gun of Claim 12 wherein said first end of said hollow tube is connected to water inlet-outlet tubing and said second end is clamped closed.

14. The toy water gun of Claim 12 wherein the said weakened section is a bubble shape.

15. The toy water gun of Claim 12 wherein the elasticity of said tubular member is such that it expands radially first and then longitudinally.

16. The toy water gun of Claim 12 wherein said bladder has an attachment to the second end of the bladder which secures the second end of said bladder and travels along the tubular housing as bladder expands until it reaches a predetermined stop.

17. The toy water gun of Claim 12 wherein said first end has an end portion which has an enlarged diameter relative to the remainder of said tubular member for attachment to an inlet/outlet tube.

18. A toy water gun for containment and ejection of water comprising:

a main housing having an ejection nozzle located thereon;

a bladder housing connected to the main housing; and

an expandable bladder located in the bladder housing, said expandable bladder being adapted to receive water under pressure and being adapted to expand and contain the water, said expandable bladder providing a motive force for water ejection, said expandable bladder comprising an elongated tubular member having a first end and a second end, said first end being in fluid communication with the

ejection nozzle, said bladder housing limiting expansion of said expandable bladder.

19. The toy water gun of Claim 18, further comprising a bladder carriage attachment located at the second end of the bladder, said bladder carriage attachment being movable in said bladder housing as said bladder is expanded.

20. The toy water gun of Claim 18 wherein said tubular member includes a wall having a variable thickness which varies from thinner to thicker along the length of said tubular member, said first end being thinner and said second end being thicker.

21. The toy water gun of Claim 18 wherein said tubular member also has a variable diameter which tapers from larger at the first end to smaller at the second end.

22. The toy water gun of Claim 18 wherein said bladder carriage attachment has a profile which is complementary to the profile of said bladder housing.

23. The toy water gun of Claim 21 wherein said tubular member expands to form a cylindrical tubular member, said bladder housing has a circular cross-sectional area and said bladder carriage has a circular cross-sectional area.

24. The toy water gun of Claim 18 wherein said bladder includes a weakened section at said first end.

25. The toy water gun of Claim 18 wherein said bladder housing limits expansion of said bladder both laterally and longitudinally.

DATED this 9th day of February 2001

Larami Limited

By their Patent Attorneys

CULLEN & CO.

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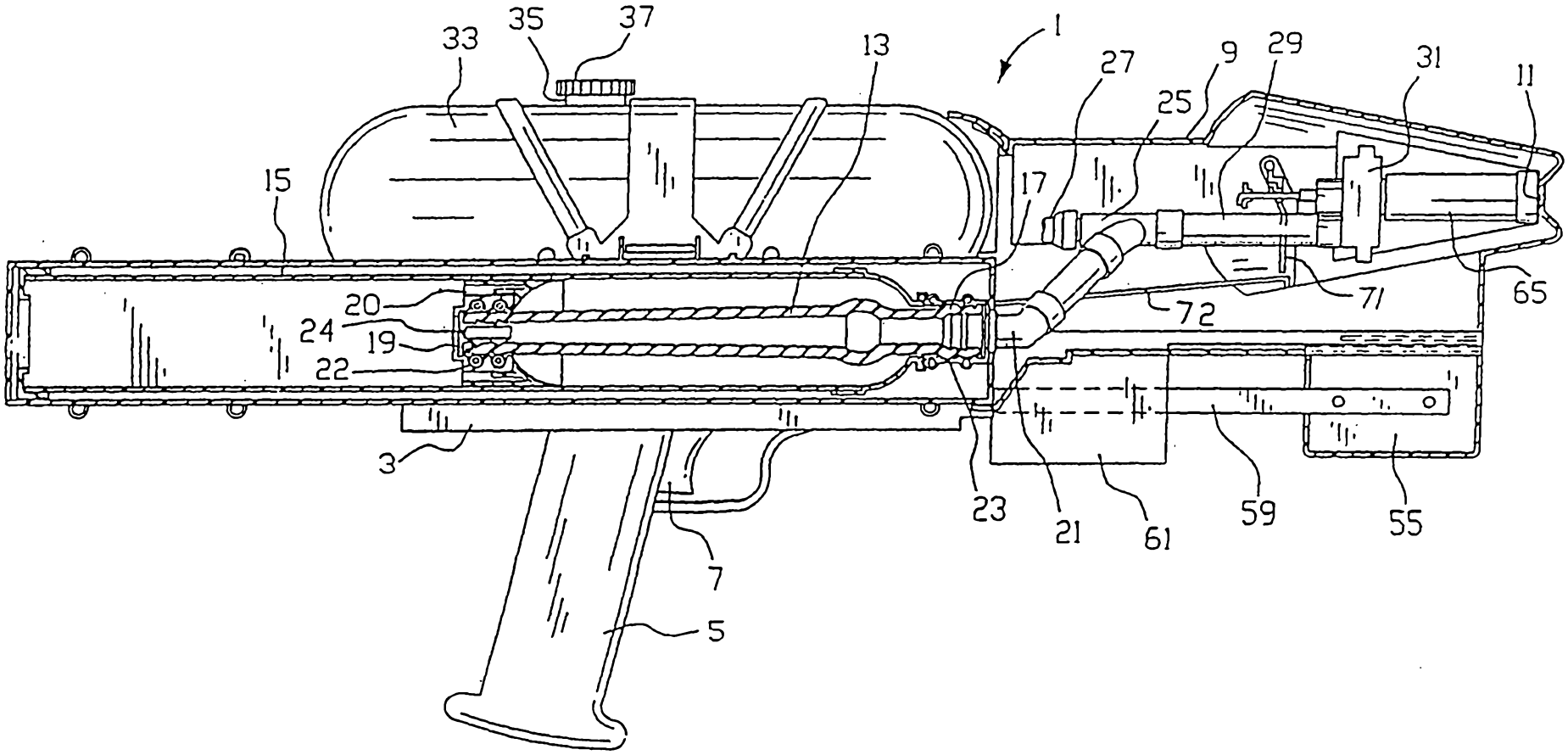

FIG. 1

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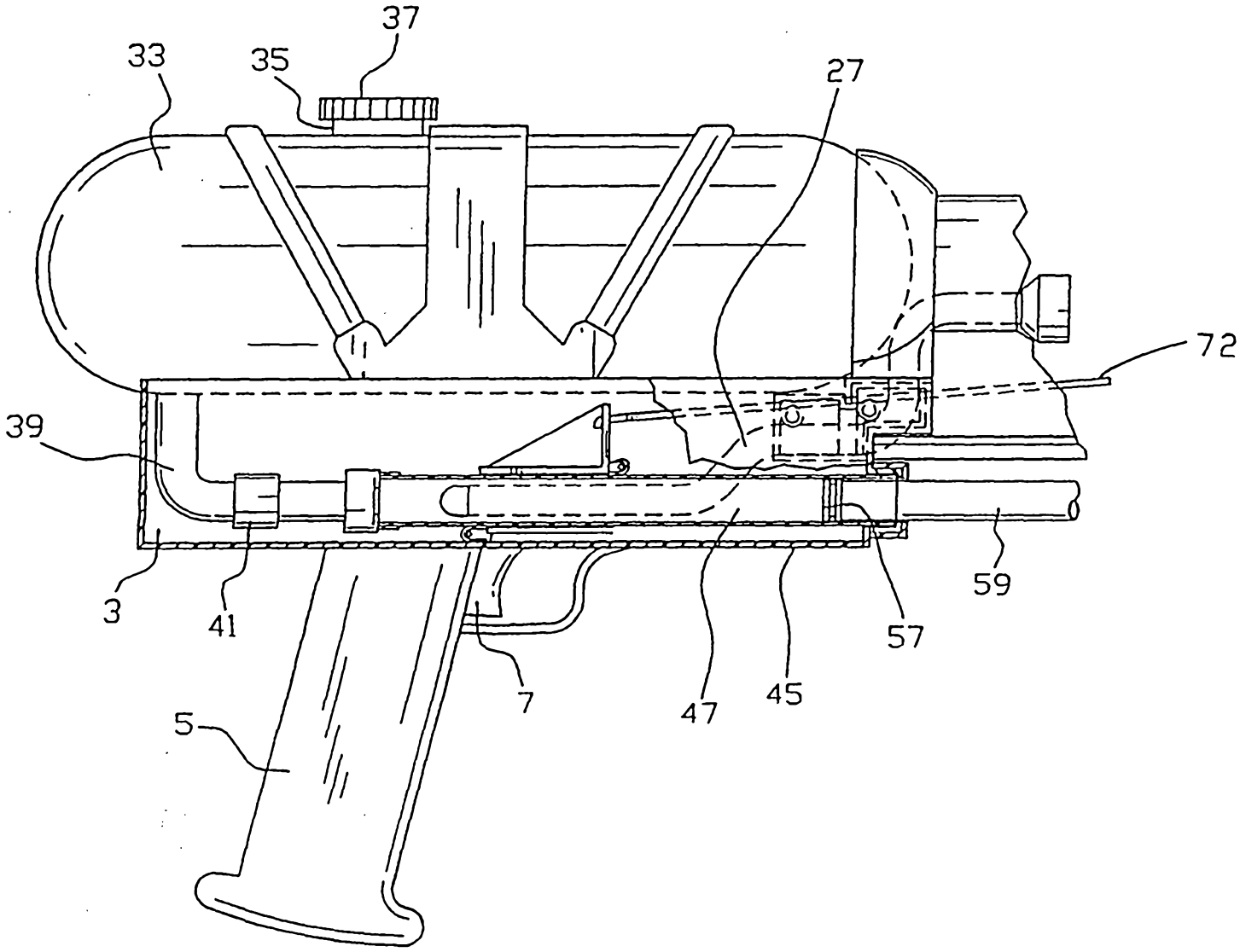

FIG. 2

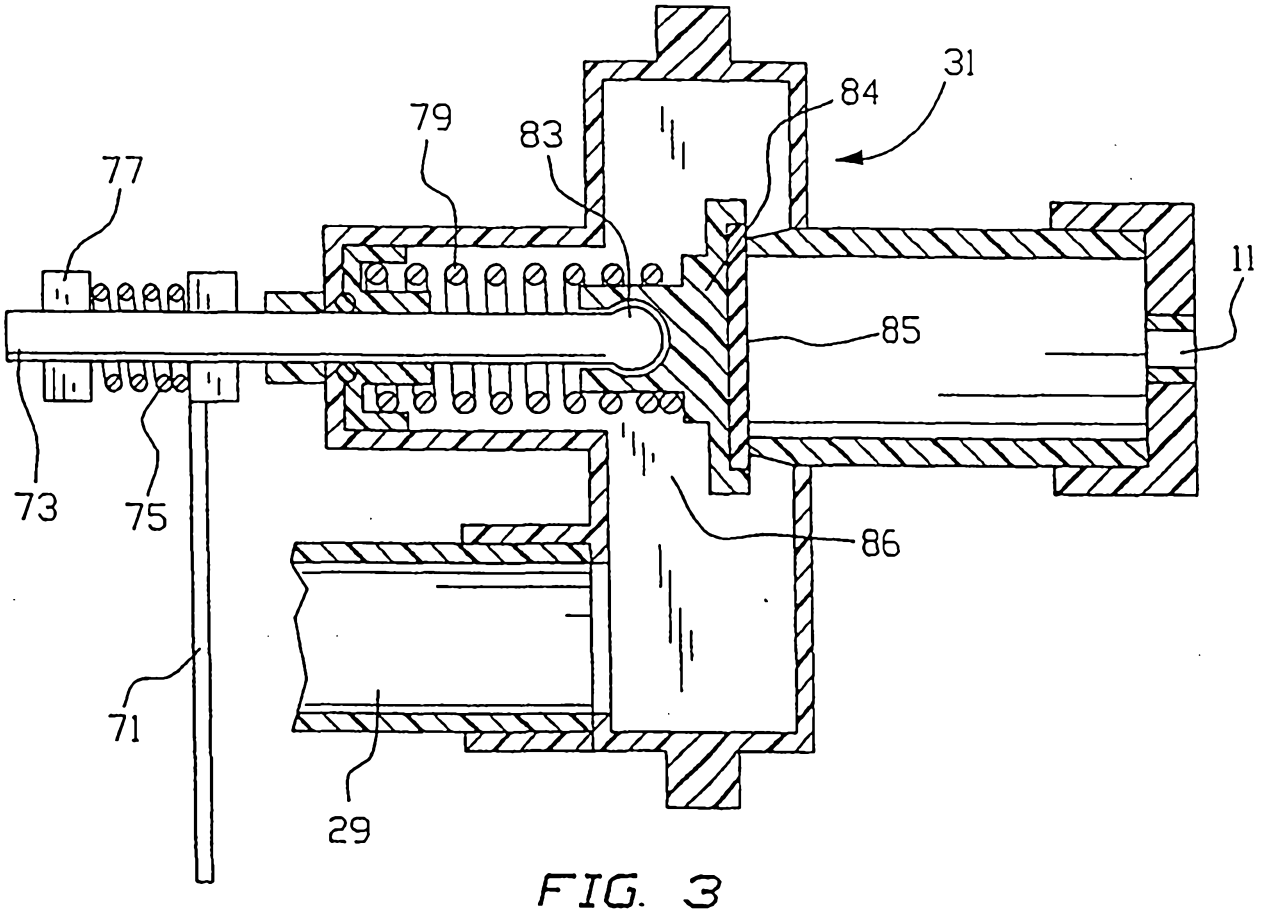

FIG. 3

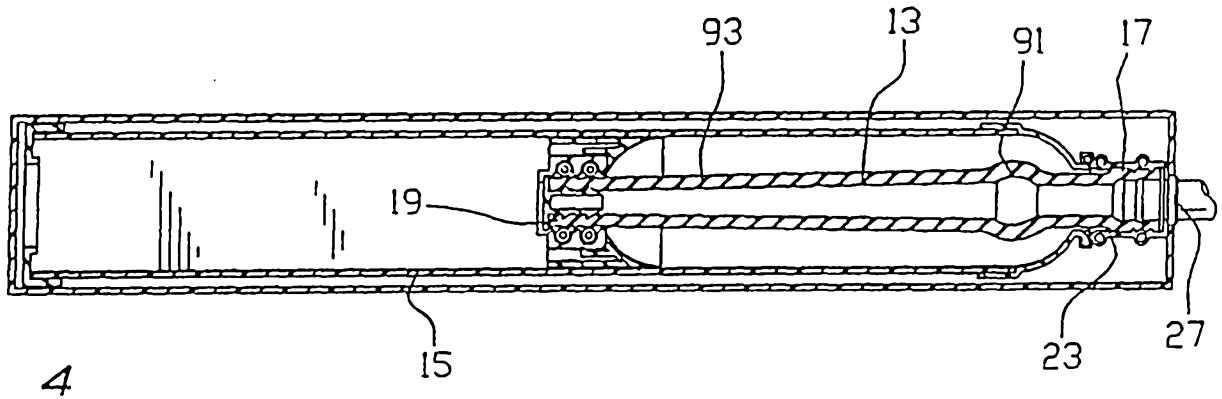

FIG. 4

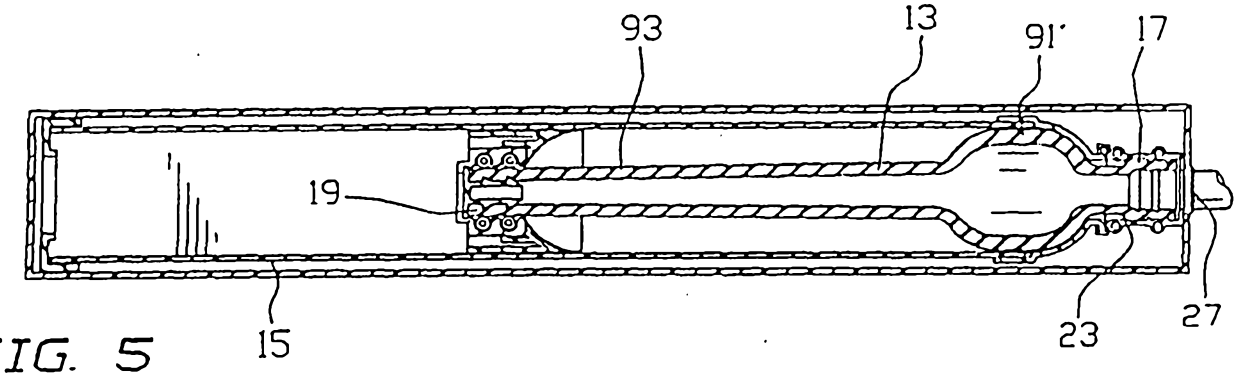

FIG. 5

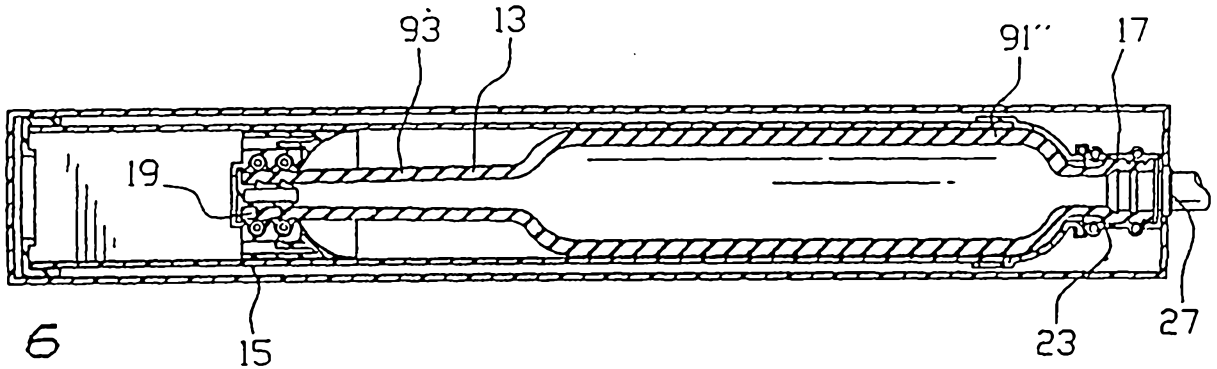

FIG. 6

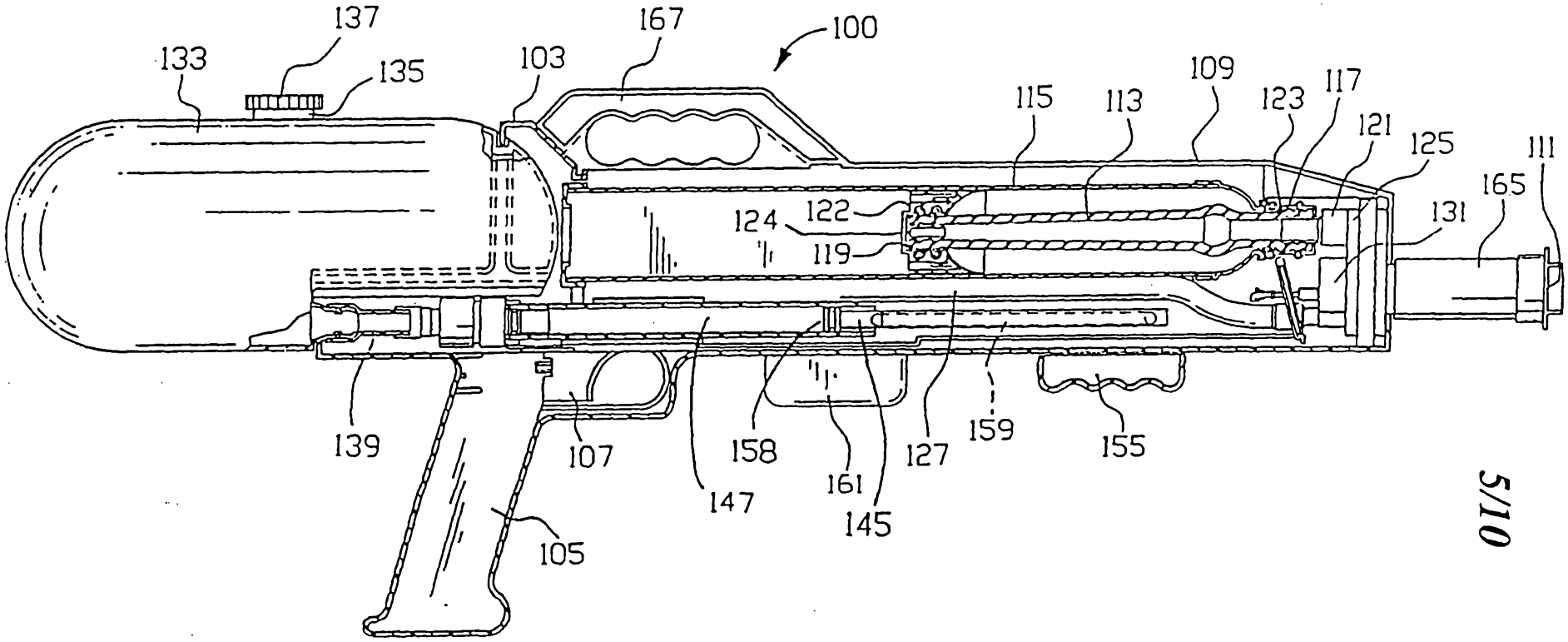
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FIG. 7

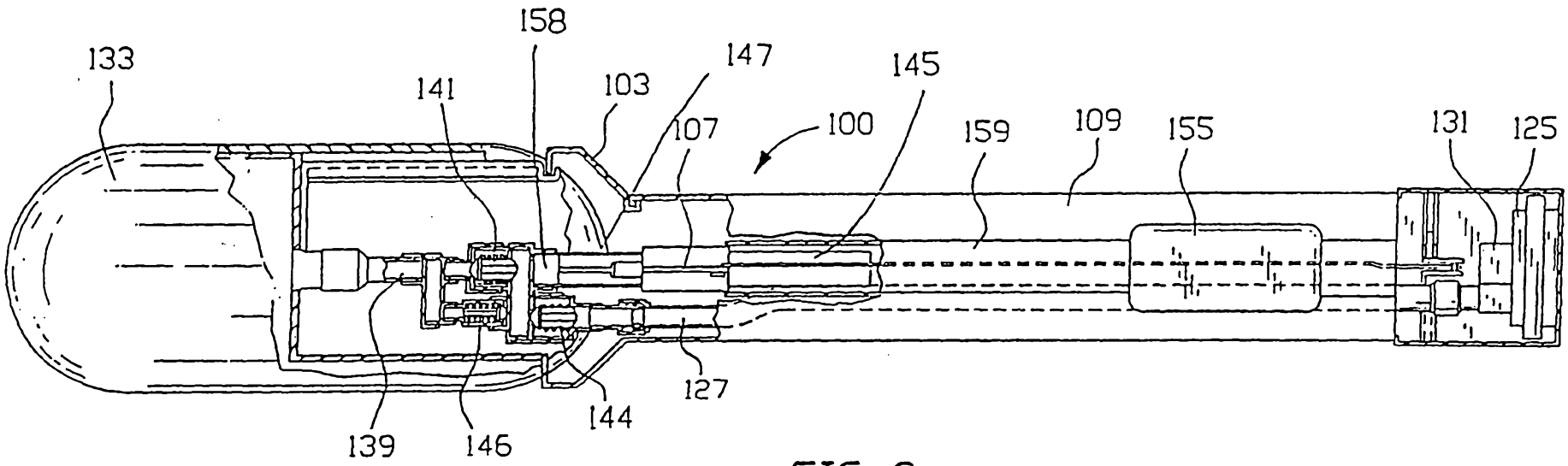
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FIG. 8

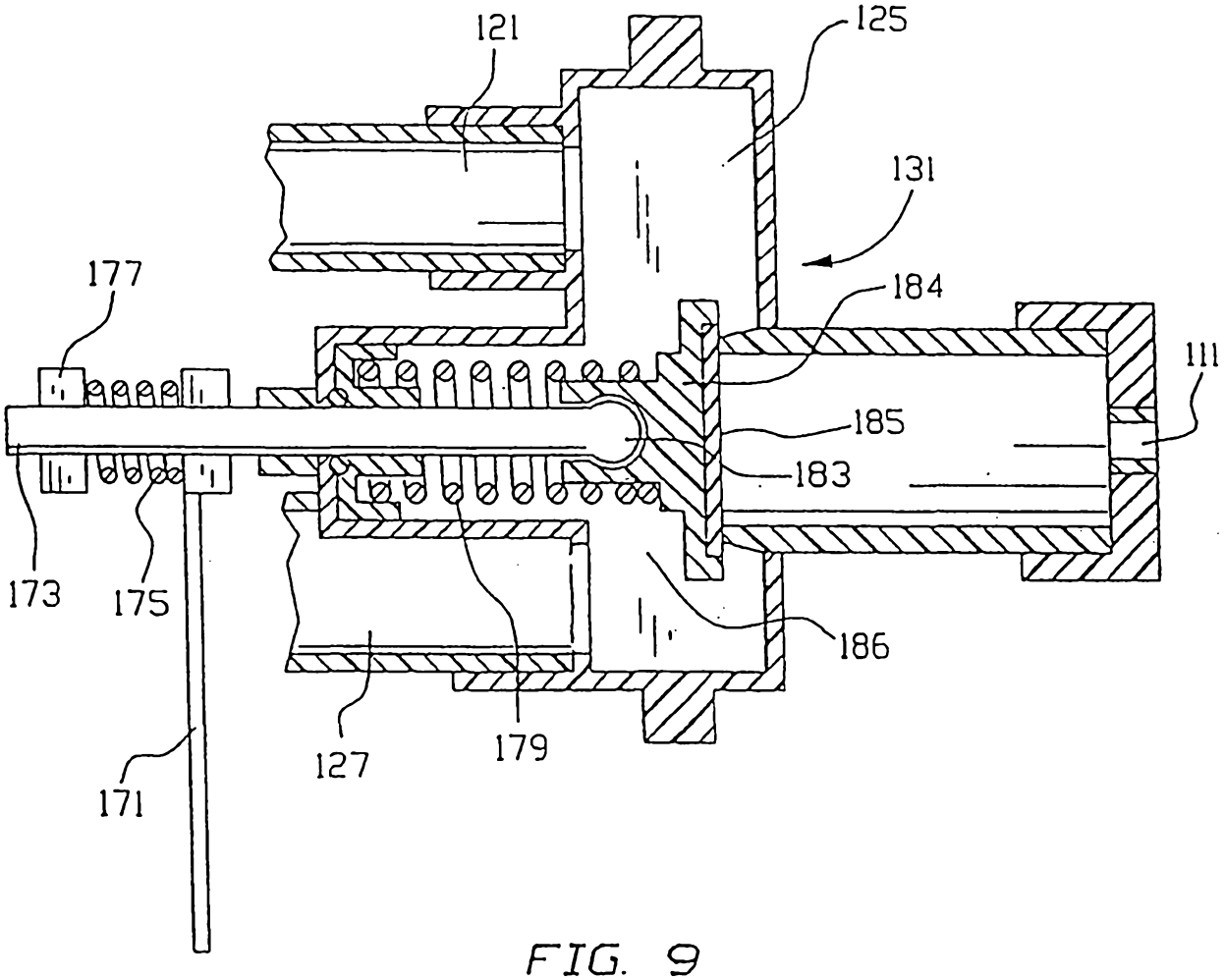

FIG. 9

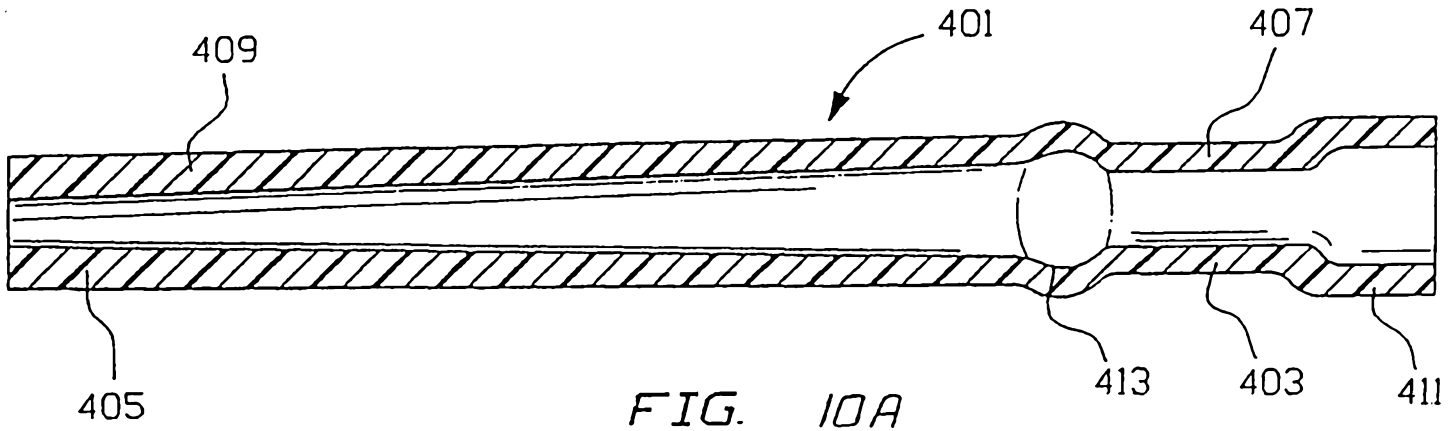

FIG. 10A

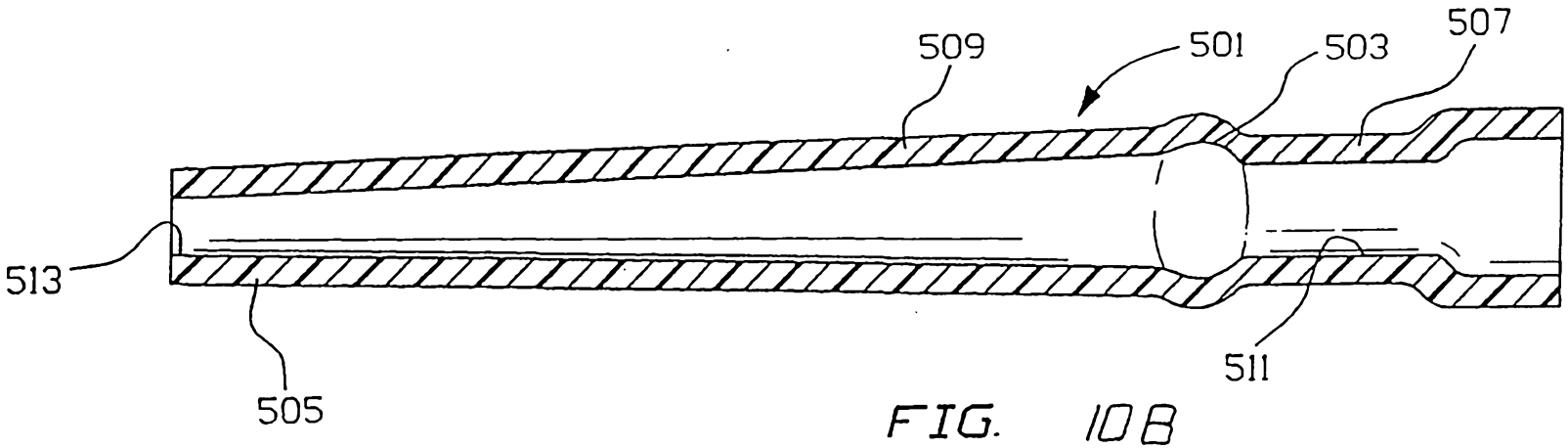

FIG. 10B

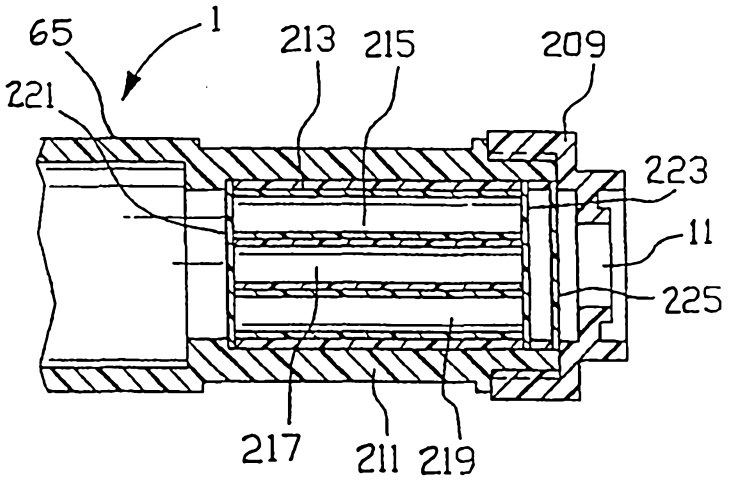

FIG. 11

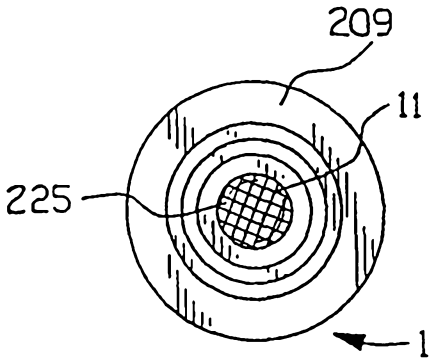

FIG. 12

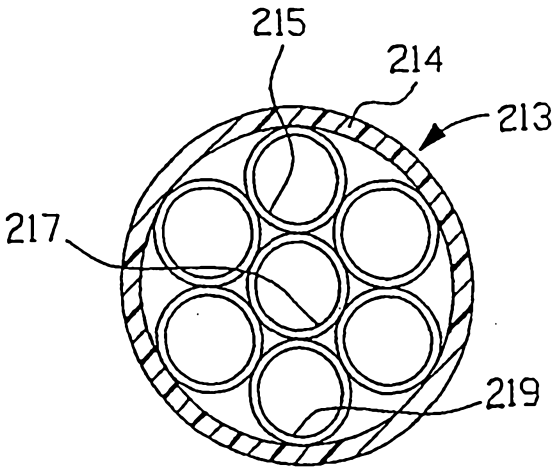

FIG. 13

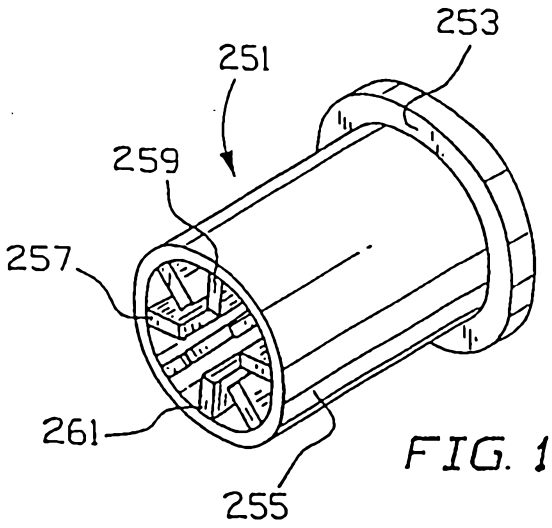

FIG. 14

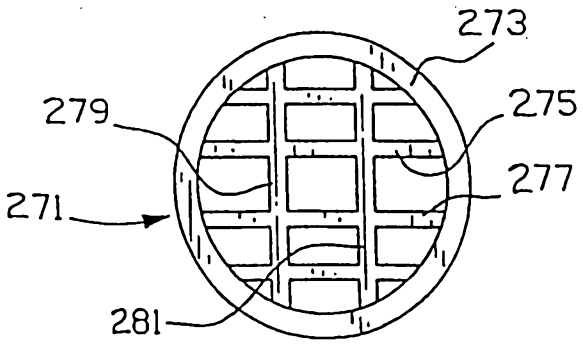

FIG. 15

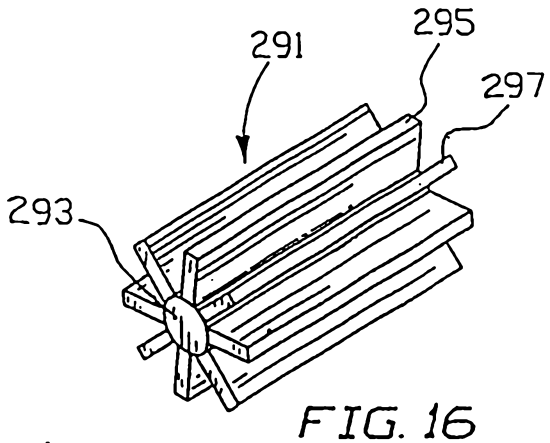

FIG. 16