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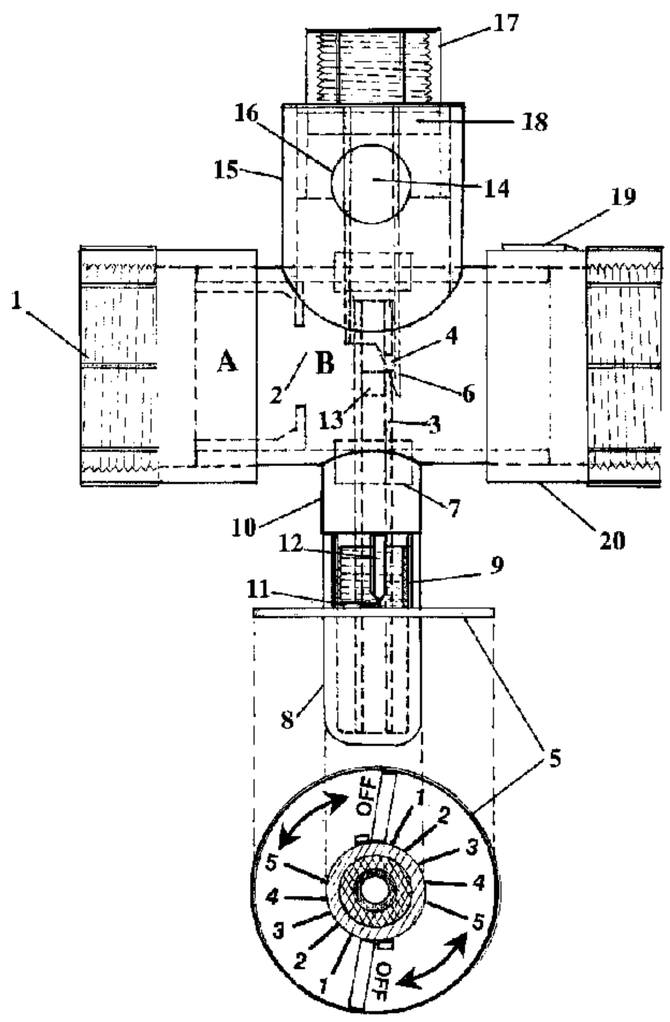
(54) Titre : METHODE ET APPAREIL DE CHLORATION EN CONTINU DE L'EAU DE PISCINE
(54) Title: METHOD AND APPARATUS FOR CONTINUOUS CHLORINATION OF SWIMMING POOL WATER



(57) Abrégé/Abstract:
A method for maintaining swimming pool water fit for use and an apparatus for implementing the same which dispenses continuously, minimal but effective amounts of treatment chemical; such method includes the continuous addition of a solution of sodium hypochlorite at suitable levels known to destroy or diminish the growth of dangerous pathogens; the continuous introduction of a solution of sodium hypocholrite into the filtration system water at levels considerably higher than in the swimming pool itself so as to further diminish and destroy accumulated pathogens on the filter bed, said water being released into the swimming pool in sufficient force to provide for adequate mixing and attainment of sterilizing concentrations safe for human health; the continuous introduction of a solution of sodium hypochlorite into the pool water in such a manner as to maintain constant levels and chemically balanced pool water which will not harm the pool liner and filtration system and reduce the total chemical burden introduced into the pool water; the apparatus for dispensing sodium hypochlorite is to be mounted directly on the vacuum side of the pool's pump and consists of a mechanism to boost the vacuum created by the pool pump, a means to control the continuous flow of a solution of sodium hypochlorite originating from a suitable reservoir and a means to observe said flow.

ABSTRACT

A method for maintaining swimming pool water fit for use and an apparatus for implementing the same which dispenses continuously, minimal but effective amounts of treatment chemical; such method includes the continuous addition of a solution of sodium hypochlorite at suitable levels known to destroy or diminish the growth of dangerous pathogens; the continuous introduction of a solution of sodium hypocholrite into the filtration system water at levels considerably higher than in the swimming pool itself so as to further diminish and destroy accumulated pathogens on the filter bed, said water being released into the swimming pool in sufficient force to provide for adequate mixing and attainment of sterilizing concentrations safe for human health; the continuous introduction of a solution of sodium hypochlorite into the pool water in such a manner as to maintain constant levels and chemically balanced pool water which will not harm the pool liner and filtration system and reduce the total chemical burden introduced into the pool water; the apparatus for dispensing sodium hypochlorite is to be mounted directly on the vacuum side of the pool's pump and consists of a mechanism to boost the vacuum created by the pool pump, a means to control the continuous flow of a solution of sodium hypochlorite originating from a suitable reservoir and a means to observe said flow.

BACKGROUND OF THE INVENTION

1. Field of the Invention

It is highly probable that for most swimming pool facilities the pool water is recirculated by an electrically actuated motor driven pump such that the pool water is filtered through either a cartridge type or sand bed filter continuously or at daily timed intervals so as to remove particulate debris (i.e. vegetative matter, dirt and bacteria), the filtered water being returned to the pool through in some cases a heating device to control temperature and in still some other cases an aeration device to further purify the water.

While filtration devices are essential to the maintenance of clean pool water, in order to keep swimming pool water substantially free from pathogens such as bacteria, viruses and algae the addition of a treatment chemical, in this case sodium hypochlorite as a solution, in a quantity sufficient under the appropriate conditions to yield free chlorine at a level which will kill said pathogens is required. Specifically with respect to free chlorine, levels ranging from approximately 3.0 – 7.5 parts per million (ppm) in water maintained within a temperature range of 22 – 35 °C and a pH of 7.2 – 7.8, should provide for optimum conditions under which said pathogens will either be destroyed through the oxidizing effect of chlorine or their growth severely attenuated.

The requirement for selected treatment chemicals is dependent on a number of factors, changes in any one or a combination of which can call upon either the need for increased levels or decreased levels of treatment chemical. Such conditions include extended periods of intense heat and elevated water

temperatures, heavy use of the pool and an elevated exposure to the introduction of contaminants (i.e. plant materials).

Sodium hypochlorite may be added to the vacuum side of the associated pumping system installed for pool water circulation. The addition of sodium hypochlorite in solution can be achieved either slowly and continuously or at predetermined intervals. Natural forces of convection, diffusion and turbulance result in a uniform distribution of sodium hypochlorite to levels which are safe and non-irritating within a relatively short period of time following introduction. The direct addition of larger quantities of a solution of sodium hypochlorite into the pool water is not recommended as damage to the pool liner may ensue due to concentrated sodium hypochlorite coming into contact with the pool liner in regions of calm water.

Environmental factors, the source of pool water (well or city) and the frequency of pool water usage can cause the overall chemistry of the pool water itself to be subject to variation. Control of the pH of the pool water is to be considered and can be most easily achieved by the addition of small amounts of sodium hypochlorite continuously or at regular intervals. Still other chemicals, either acids (i.e. hydrochloric) or bases (i.e. sodium carbonate) may also be disseminated throughout the pool by the recirculation pump and natural forces of diffusion in order to control pH. The control of pH as it directly relates to sodium hypochlorite is critical to minimize excessive chemical breakdown resulting in the production of high levels of free chlorine and organic chlorine derivatives (i.e. chloramines) which in certain concentrations irritate human tissues. In addition,

still other water stabilizing chemicals such as algaecides, calcium reducing agents and copper and other heavy metal chelators may be required to control algae growth and maintain the safe quality of the swimming pool water and to protect the pool liner. The activity of swimming pool water chemical additives is not only dependent upon achieving suitably effective concentrations but is highly dependent on the maintenance of chemically stable water. Following introduction and distribution of the treatment chemical and other water controlling chemicals at predetermined intervals, their effective concentrations diminish or shift through decomposition, reaction with contaminants or by decomposition via exposure to short wave ultraviolet radiation present in sunlight. Specifically with respect to sodium hypochlorite, the rate of change of its effective concentration will depend on the rate at which it is being reintroduced into the swimming pool and by the use of other chemical additives in combination with sodium hypochlorite which slow down its decomposition (i.e. cyanuric acid).

Commercially available kits provide a procedure whereby pool water can be tested for free chlorine concentration and pH. In cases where there is additional need for chemical conditioning of the pool water, additives can be measured out and added to the pool in sufficient quantity by physically introducing at specific points at the pool periphery. The need for readjustment of the levels of chlorine in swimming pool water and according to procedures indicated by the use of a pool testing kit which measures free chlorine may result in a shift in the concentrations of sodium hypochlorite to levels beyond acceptable. Such levels

may be beyond the limits for either comfort or safety. To the contrary, the addition of inadequate concentrations of treatment chemical may provide conditions which support the growth of the contaminants. Despite the use of a pool testing kit for the determination of appropriate chlorine, the addition of either too much or too little chlorine is most often encountered when treatment of the pool water is achieved by physical introduction of sodium hypochlorite.

2. Description of the Prior Art

There exist a variety of dispensing devices for the controlled addition of liquid chlorine into swimming pools, of which include timer controlled metering pumps, gravity feed tanks, timer controlled and vacuum assisted solenoid operated gate and pinch-type valves and vacuum assisted flow-through restriction tubes of varying lengths and/or diameters. However, such devices have several disadvantages. Timer controlled metering pumps are expensive to purchase and maintain, require an electrical hook-up and have a tendency to air-lock. Gravity feed tanks are often cumbersome and are prone to changes in head pressure as the level of liquid chlorine falls in the tank. Timer controlled vacuum assisted solenoid gate valves are also expensive due to the inert material utilized in their construction which is necessary as corrosive liquid chlorine comes in contact with the inner body of the solenoid. Timer controlled vacuum assisted solenoid pinch-type valves stop the flow of liquid chlorine by collapsing tubing made of a material which is not completely inert to the liquid chlorine. As such the tubing must be changed every year giving rise to the possibility of failure due to improper maintenance and leakage of corrosive liquid chlorine. Furthermore, a low applied vacuum as encountered on a pool pump connected to an above ground pool (a consequence of the head pressure of water encountered when the pool pump is situated below the water line) generally limits the use of vacuum assisted solenoid valves. Still yet another limitation is the lack of a suitable portal of entry on the pool pump for connecting

the vacuum to the solenoid operated valve. Vacuum assisted continuous flow devices with flow-through restriction tubes of varying lengths and/or diameters are subject to a high degree of variation in the flow of liquid chlorine should the applied vacuum from the pool pump be low as is encountered for above-ground pools (see above). An additional limitation to these devices is the high flow impedance making them susceptible to flow obstruction caused by dirt accumulation. With this invention the use of flow-through restriction tube to control the flow of sodium hypochlorite, an embodiment of the prior art, is substantially improved upon. As will be described the continuous addition of a solution of sodium hypochlorite which is a principle embodiment of this invention is now accomplished by a modular design which incorporates the following concept: a replaceable filter and flow-through restriction tube of a short fixed length, said flow-through restriction tube being considerably less subject to blockage as a consequence of its length and employment of a filter. The flow through said flow-through restriction tube is controlled by the vacuum originating from the pool pump whereby there exists a means to modulate said vacuum and a means to visualize the flow of a solution of sodium hypochlorite. The continuous addition of a solution of sodium hypochlorite can actually reduce the need to increase the chemical burden of pool water by the use of additional treatment chemicals. The implementation of this invention will yield a body of water having a constant pH and that is fit for use under all stages and conditions of application of the method.

Patent Literature Cited:

Canadian Patent # 2,145,929
Canadian Patent # 2,093,603
Canadian Patent # 1,130,897
Canadian Patent # 1,068,020
U.S. Patent # 4,208,376

3. Objects of the Invention

The principle object of this invention is provide for the proper maintenance of a recirculated and filtered body of water, particularly swimming pool water, such that it is substantially clear and free from bacteria and algae over an extended period of time and suitable for use via the adoption of a continuous introduction of minimum amounts of a solution of sodium hypochlorite, thereby reducing the requirement for the usual practice of scheduled testing of the pool water.

Another important object is to provide an improved method for dispensing a solution of sodium hypochlorite which can be adapted to recirculating swimming pool water installations over a range of pool sizes and under a variety of conditions.

An additional important object of the invention is to provide an improved method for delivery of a solution of sodium hypochlorite which is susceptible of implementation and control through an automated apparatus in order to relieve either the pool owner or operator from the demands of daily supervision.

An additional very important object of the invention resides in the continuous delivery of a solution of sodium hypochlorite in such a manner which destroys or greatly retards the growth of bacteria, viruses and algae, that is of minimal irritation to skin and affords clean chemically balanced pool water at all times.

Still another very important object of the invention resides in providing equipment and control devices which do not employ electrical circuitry, are

compact, dependable, easily serviced and replaced, and available at a reasonable cost.

Other objects and advantages of the invention will become apparent on reading the following summary and detailed description of the preferred embodiments of the invention considered in connection with the accompanying drawing figures.

SUMMARY OF THE INVENTION

The major feature of this invention is in the provision of a method for the continuous introduction of a solution of sodium hypochlorite into a filtered and recirculated body of water, such as a swimming pool, thereby maintaining it substantially clear and free from contaminants such as bacteria, viruses and algae. The present invention relates to an automatic swimming pool chlorinator which consists of a main conduit that carries the pool water and to which is attached two female threaded adapters via which to attach it to the pool's circulation pump and filtrations system plumbing, the direction for attachment demonstrated on the plumbing fixture; a venturi located inside the main conduit to boost the pool pump vacuum, especially important for an above ground pool since the pump and filtration system usually lie below the swimming pool water line and are subject to a hydrostatic pressure which compromises the vacuum created by the pool pump; a viewing chamber connected to a rotatable conduit which is centralized within the main conduit, said rotatable conduit having an opening which can be positioned either directly facing the flow of water, minimum vacuum, ninety degrees to the flow of water, maximum vacuum, or 170 degrees to the flow of water behind a protective flange; the positioning of said opening on said rotatable conduit being determined by a clearly graduated dial; said viewing chamber is made of transparent plastic material enabling the pool operator to ensure that the flow of a solution of sodium hypochlorite into said rotatable conduit and consequently into the flow of water entering the filtration apparatus has been achieved and is being maintained; a housing for said

viewing chamber having two viewing ports horizontally opposed for observation of said vacuum chamber, said housing also containing a threaded female adapter; a plastic cap which screws into said housing securely, is sealed by an o-ring and contains a drip-tube device which projects into the vacuum chamber, a conduit permitting the entry of minute quantities of air and a nipple for attaching a length of plastic flexible hose; said flexible plastic hose is of small diameter and can be attached and fastened onto the nipple of said plastic cap; a rigid piece of plastic tubing, to now be known as a dip-tube, which is firmly attached onto the other end of the plastic hose; a support to hold the dip-tube securely in a commercially available reservoir of sodium hypochlorite; a length of polyethylene tubing of small diameter, 0.38 mm, which is protected by a housing and filter of mesh size 0.24 mm and is now to be known as the flow regulator; said flow regulator is attached to said dip-tube in said support and immersed in the solution of sodium hypochlorite. In accordance with the present invention, the housing consists of the major water conduit to which the individual components are attached, the venturi, female threaded adaptors, the rotatable conduit and dial, the viewing chamber which is protected by a housing with observation ports and a threaded female adapter.

Brief Description of the Drawing Figure

Figure 1 shows a full scale view of the housing portion of the apparatus for the automatic chlorination of swimming pool water detailing the individual components highlighted by number.

Figure 2 shows a full scale view of the plastic cap and dip-tube detailing the manner in which the flexible plastic hose is attached, the dip-tube support and the flow regulator.

Figure 3 shows the positioning of the apparatus for the continuous chlorination of swimming pool water on an above ground swimming pool.

Description of an Example Embodiement

Referring to drawing Figure 1, activation of the pool pump draws water through the housing and past individual components of the apparatus which are either made of ABS, polyvinyl, or polyethylene plastic. Water first passes through the major conduit (1) section A, the water impacting on venturi (2) the consequence of which is an increase in the velocity of the flow of water into section B, section B being under a greater vacuum then section A. Water with an increased velocity subsequently flows past a rotatable conduit (3) which has an opening (4) of 4 mm in diameter. Positioning of the opening directly into the flow of water in the major conduit results in an impacting of water into the opening and a reduction of the vacuum within the rotatable conduit. Rotation of the conduit via the graduated dial (5) results in the repositioning of the opening and upon attaining a configuration of 90° to the flow, there is the development of maximum vacuum within the rotatable conduit in part due to an aspiration effect. The variance in vacuum for above ground pools equipped with a standard pool pump of ½ horse power or greater will be from 2 mm Hg with the opening positioned directly into the flow to as high as 12 mm Hg with the opening positioned at 90° to the flow. In the case of in-ground pools the variance in

vacuum will range from 6 mm – 15 mm Hg. Repositioning of the hole to 170° from the flow will result in placing the opening behind a protective flange (6) made of acrylate plastic (OFF position, as is shown in Figure 1). Turing to the OFF position allows for the removal of debris potentially trapped in said opening by passing it across the protective flange. The position of said rotatable conduit is measured by means of said graduated dial (5) which is readable from both sides of the main conduit. The rotatable conduit rotates within a silicone grease lubricated Tygon seal (7) to protect the vacuum in portion B of the main conduit. The rotatable conduit is fastened into the dial housing (8) and the dial housing is threaded (9) into the main conduit via a female adaptor (10). A stopper on the dial (11) impinges on the dial pointer (12) to prevent over rotation and unsrewing of the dial. A similar stopper/dial pointer arrangement is horizontally opposed on the other side of the dial assembly. The vacuum within the rotatable conduit is maintained by a silastic tubing seal (13), the rotatable conduit being slip-fit into the viewing chamber (14) to which it transfers the pool pump vacuum. The viewing chamber is made of rigid transparent acrylate plastic tubing. The purpose of the viewing chamber is to monitor the flow of the solution of sodium hypochlorite. The viewing chamber is protected by a housing (15) which has two viewing ports (16) which are horizontally opposed and a threaded female adaptor (17) which is sealed against said viewing compartment by means of a rubber gromet (18). The direction of water flow through the main conduit is indicated by means of an arrow (19) located on one of the threaded female

adaptors (20) used to connect the main conduit onto the filtration system plumbing.

Now referring to drawing Figure 2, the cap (21) which is made of polyvinyl chloride plastic and is polyester resin filled is screwed onto the female adaptor located on the housing of the viewing compartment and sealed by means of an 0-ring (22). The cap has a polypropylene plastic nipple (23) onto which to attach a 75 cm length of flexible polyvinyl chloride transparent plastic hose (24) having an O.D. of 6 mm and an I.D. of 3 mm. The flexible plastic hose is secured to the nipple by means of a small piece of silicone rubber tubing (25) which is attached to the plastic hose by a cable tie (26). When in place the silicone rubber tubing grips the flexible plastic hose to the nipple, however it can easily be removed if need be. The cap also has a drip-tube (27) which extends, once the cap is screwed onto the housing, into the viewing chamber. The purpose of the drip-tube is to allow the pool operator to view the flow of a solution of sodium hypochlorite in a drip-wise fashion. The cap also contains a conduit of length 25 mm, outer diameter 2 mm and inner diameter 0.10 mm (28) which permits small quantities of air to continuously enter the viewing chamber thereby preventing it from filling up with water or a solution of sodium hypochlorite at settings where the vacuum in the viewing chamber is low. The entry of a very small amount of air into the pump and filtration system will not cause undue harm and will be discharged into the pool with the return flow of water. The other end of the flexible plastic hose is attached to a dip-tube (29) made of polyethylene plastic by inserting part way into the dip-tube and securing with a

small piece of silicone rubber tubing (30) and a cable tie (31). A rubber gromet (32) is placed on the dip-tube. It is to be snug fit into the dip-tube support (33) as illustrated and serves to stabilize the dip-tube in the dip-tube support. The dip-tube support is designed to fit inside or over the various sizes of openings (narrow, wide and extra wide) available with commercial sodium hypochlorite carboys. Sliding the rubber gromet up and down the dip-tube will enable the dip-tube to accommodate different depths of liquid chlorine carboys. The flow regulator (34) is snug-fit into the dip-tube by means of the tapered end (35), the filter end (36) located opposite to the tapered end; the dip-tube and flow regulator being immersed into the solution of sodium hypochlorite.. Upon receiving an applied vacuum originating from the pool pump, a solution of sodium hypochlorite is drawn-up initially through the mesh polyethylene filter (37), and then through a small polyethylene tubing of diameter 0.38 mm and length 75 mm (38) contained in the body of the flow regulator. The solution of sodium hypochlorite enters the dip-tube and subsequently the flexible plastic tubing to eventually enter the cap and drip slowly from the drip-tube as observed in the viewing chamber. The applied vacuum can either be increased or decreased by means of turning the adjustment dial which is affixed to the rotatable conduit. The greater the applied vacuum, the greater the flow of sodium hypochlorite solution into the rotatable conduit. The flow of sodium hypochlorite solution is subsequently directed through the opening located in the rotatable conduit and then into the return flow of water entering the swimming pool. Therefore, depending on the temperature of the water, the pool operator

can either add more or less of a solution of sodium hypochlorite to the swimming pool by simply turning the dial attached to the rotatable conduit. The pool operator will therefore be able to maintain the levels of chlorine within the critical range required to suppress the growth of contaminant microorganisms and algae.

Now referring to Figure 3, the location on an above ground pool of the apparatus for the continuous addition of liquid chlorine (39) is shown with respect to the pool skimmer (40), the pool pump (41) and filter (42) and the chlorine reservoir (43).

Additional Details:

Pump Characteristics and Attachment: The chlorinator housing is easily attached to the main conduit leading into the pump at a distance no greater than two feet and to a conduit which does not contain any flow restrictions with a diameter equal to or less than that of the venturi. The pool pump must be of ½ horse power or greater.

Removal of Solid Debris from the Swimming Pool: The venturi and rotatable conduit have been so positioned such that moderately sized particulate debris collected by use of a hand-held or automated vacuum device will not interfere with the flow of water through the main conduit. In accordance with swimming pool and pump manufacturer's, it is recommended that large debris be removed with a hand-held skimmer prior to vacuuming to prevent blockage of the pool plumbing.

Servicing: The apparatus for automatic chlorination will have to be serviced only occasionally. The flow regulator can be easily removed either for replacement or for cleaning of the filter. The cap can also be easily removed to clean the vacuum chamber and rotatable conduit of deposits. The modular design of the apparatus for continouous chlorination allows for easy servicing.

Flow Regulator: The flow regulator designed as described will permit a certain maximum flow at the maximally applied vacuum. However, maximum flow through the flow-regulator can be increased or decreased by either shortening or increasing the length of the polyethylene flow-through restriction tube respectfully. Therefore the design of the flow modulator can be easily modified from the standard design should there be a need to do so.

In the specific description and drawing figures, there has been set-forth a preferred embodiment of the apparatus for the continuous chlorination of swimming pool water for the present invention. Specific terms have been employed in describing the invention and are not intended for purposes of limiting the scope of the invention being defined in the following claims.

What is claimed is:

1. An apparatus for the continuous addition of a solution of sodium hypochlorite into swimming pool water comprising a flow modulator located in the reservoir of said sodium hypochlorite solution which is for controlling the flow of said sodium hypochlorite solution generated under the vacuum of the pool pump, a rigid dip-tube held in place by a support which directs the flow of said sodium hypochlorite solution into a flexible plastic tubing, the flow

proceeding into a housing which has the means to both boost and modulate the pool pump vacuum and a means to direct the flow of said sodium hypochlorite solution into the stream of pool water which flows through said housing and enters the suction side of the pool pump.

2. An apparatus as described in claim 1 wherein said flow restrictor controls the flow of sodium hypochlorite by directing the flow initially through a polyethylene filter and then through a fixed length of narrow diameter polyethylene tubing.
3. An apparatus as described in claim 1 wherein said apparatus contains a housing which can be connected onto the suction side of the pool pump by means of the appropriate plumbing fixtures.
4. An apparatus as described in claim 1 wherein said housing includes a means for application of the pool pump vacuum into a viewing chamber for visualization in a drip-wise fashion, the flow of said solution of sodium hypochlorite into the flow of water entering the suction side of the pool pump.
5. An apparatus as described in claim 1 wherein said housing includes a means to either increase or decrease said vacuum being applied to said viewing chamber for visualization in a drip-wise fashion the flow of said solution of sodium hypochlorite.
6. An apparatus as described in claim 4 in which said means to control the vacuum being applied to said viewing compartment for visualization in a drip-wise fashion the flow of said solution of sodium hypochlorite involves a rotatable conduit having an opening which can be turned directly into or 170°

away from the flow of water entering the suction side of the pool pump, said conduit being joined to said viewing chamber for visualization of the flow in a drip-wise fashion.

7. An apparatus as described in claim 6 in which said opening on said rotatable conduit directs the flow of said solution of sodium hypochlorite from said viewing chamber for visualization of the flow in a drip-wise fashion into the flow of water entering the suction side of the pool pump.

8. An apparatus as described in claim 5 in which the position of said rotatable conduit is marked by means of a graduated dial.

9. An apparatus as described in claim 1 by which the means for boosting the vacuum of the pool pump involves directing the flow of water entering said housing through a venturi located in the front of said rotatable conduit.

10. An apparatus as described in claim 1 in which said reservoir of sodium hypocholrite solution can be replaced by any treatment chemical which can be continuously added as a particulate free aqueous solution to swimming pool water thereby making it substantially clear and free from contaminants such as bacteria, viruses and algae.

Figure 1

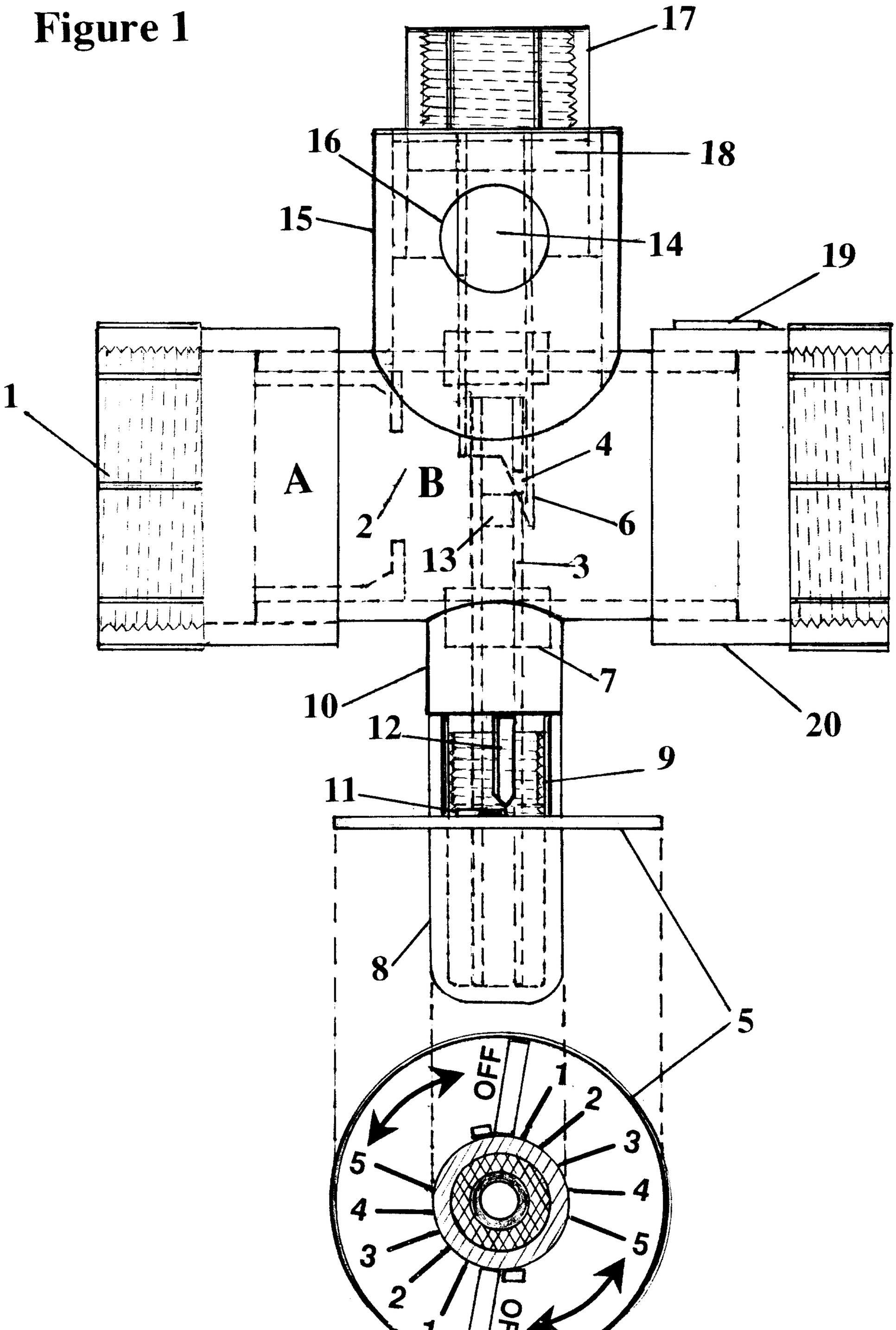


Figure 2

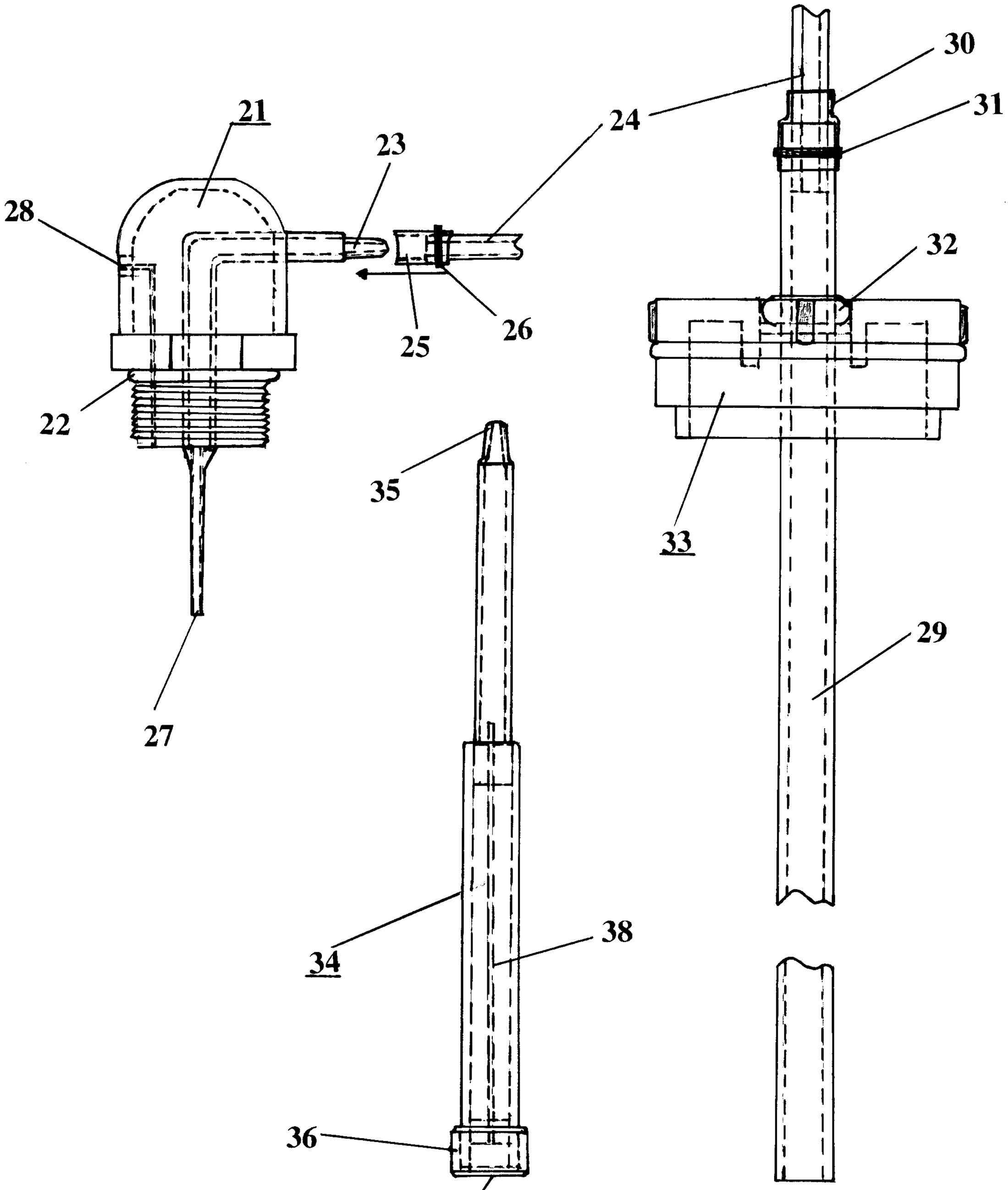
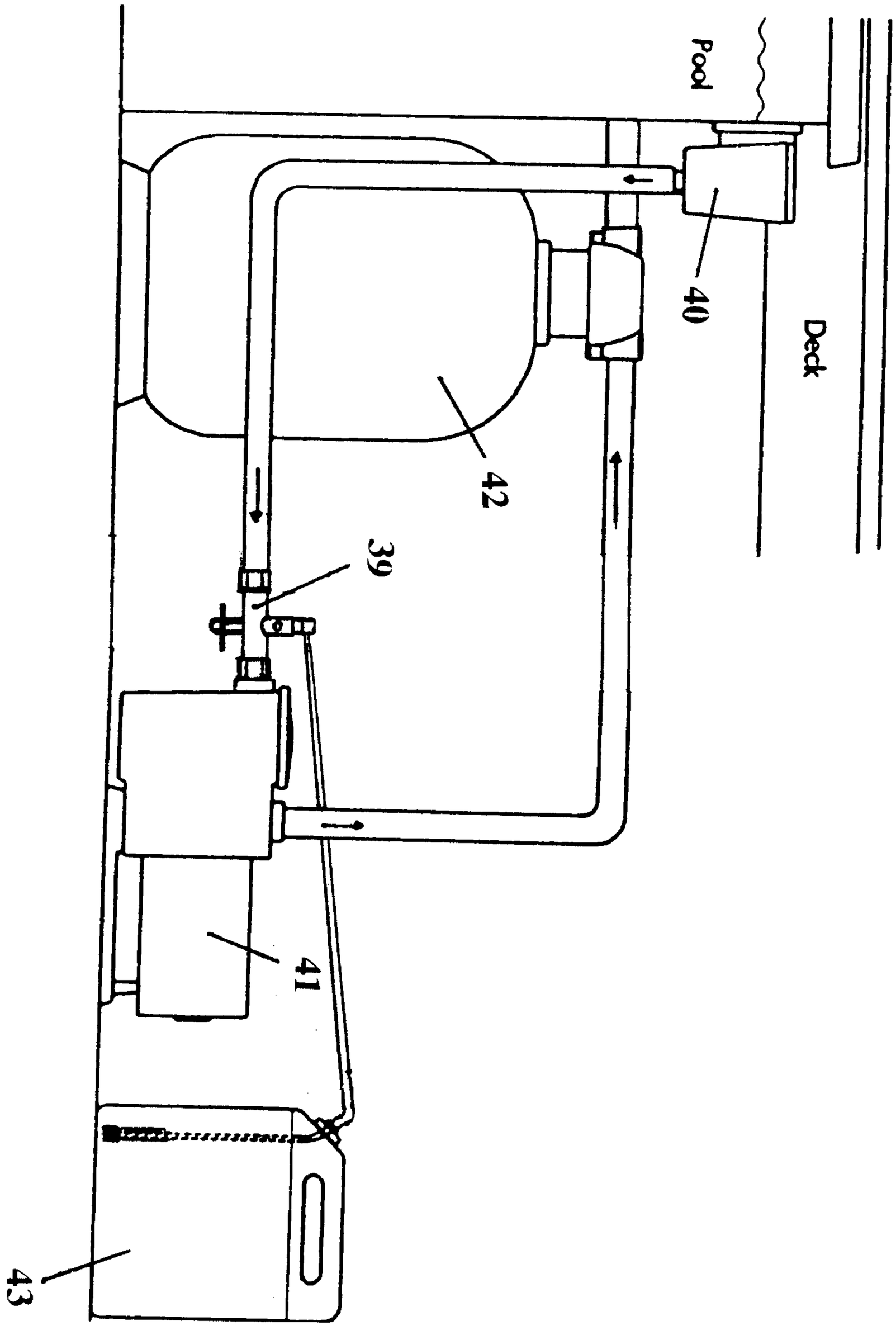
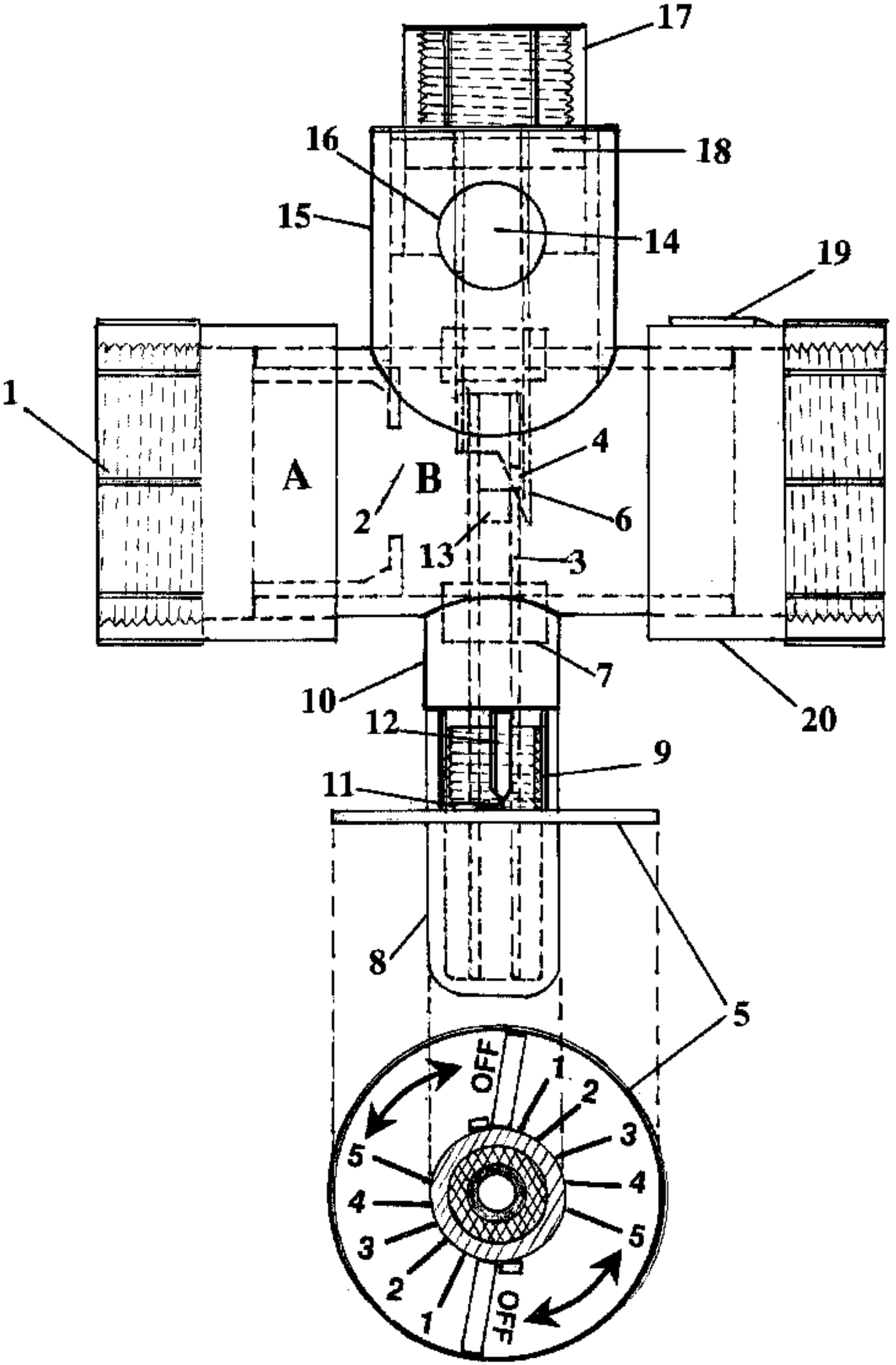


Figure 3

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