United States Patent

[11] 3,626,972

[72] Inventor Walter C. Lorenzen
Hacienda Heights, Calif.

[21] Appl. No. 73,564
[22] Filed Sept. 18, 1970
[45] Patented Dec. 14, 1971
[73] Assignee Anzen Products, Inc.
Arcadia, Calif.
Continuation-in-part of application Ser. No. 809,605, Mar. 21, 1969, now abandoned.

[54] SOLUBLE GRANULE FEEDERS
8 Claims, 9 Drawing Figs.

[52] U.S. Cl. 137/268, 137/109, 210/123
[51] Int. Cl. E03c 1/046
[50] Field of Search ..... 137/268, 109; 210/97, 123 X, 169, 136

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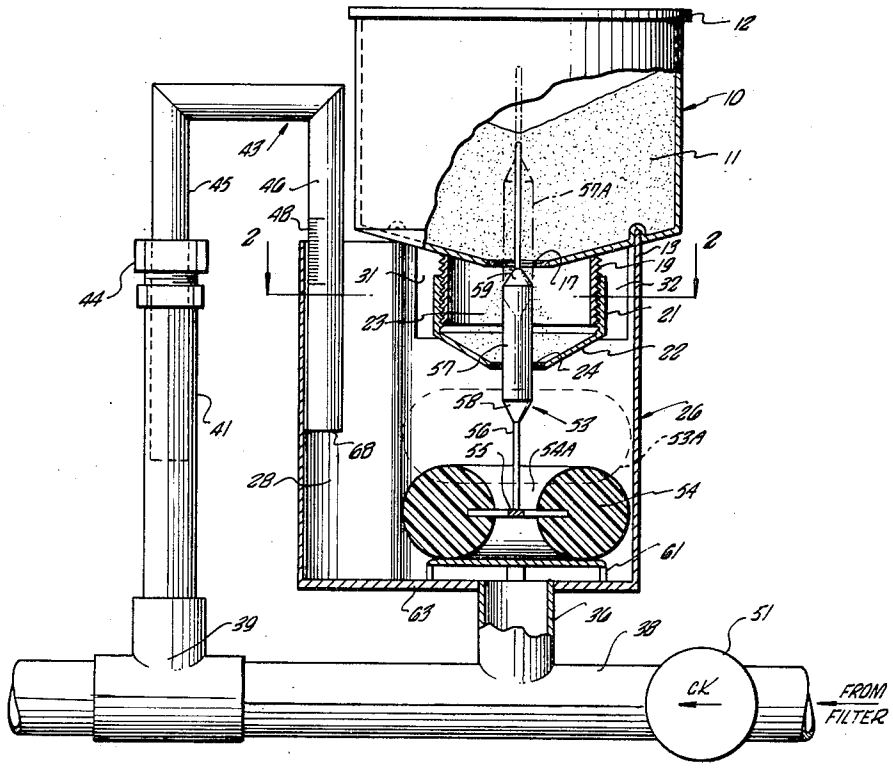
Primary Examiner—Samuel B. Rothberg
Assistant Examiner—William H. Wright
Attorney—Wm. Jacquet Gribble

ABSTRACT: A tank through which a proportion of return line liquid from a pool is bypassed when the pool pump is on receives soluble granules from an adjustable metering cup depending from a granule supply bin connecting to the tank. A valving cylinder responsive to a float in the tank alternately opens the bin to the metering cup or the cup to the tank in response to the on-off cycling of the pool pump. Flow through the tank is from the pool water circulation line bypass into the tank, through the tank to a return line independent of or downstream of the pump. A check valve intervenes between the tank and the pump.



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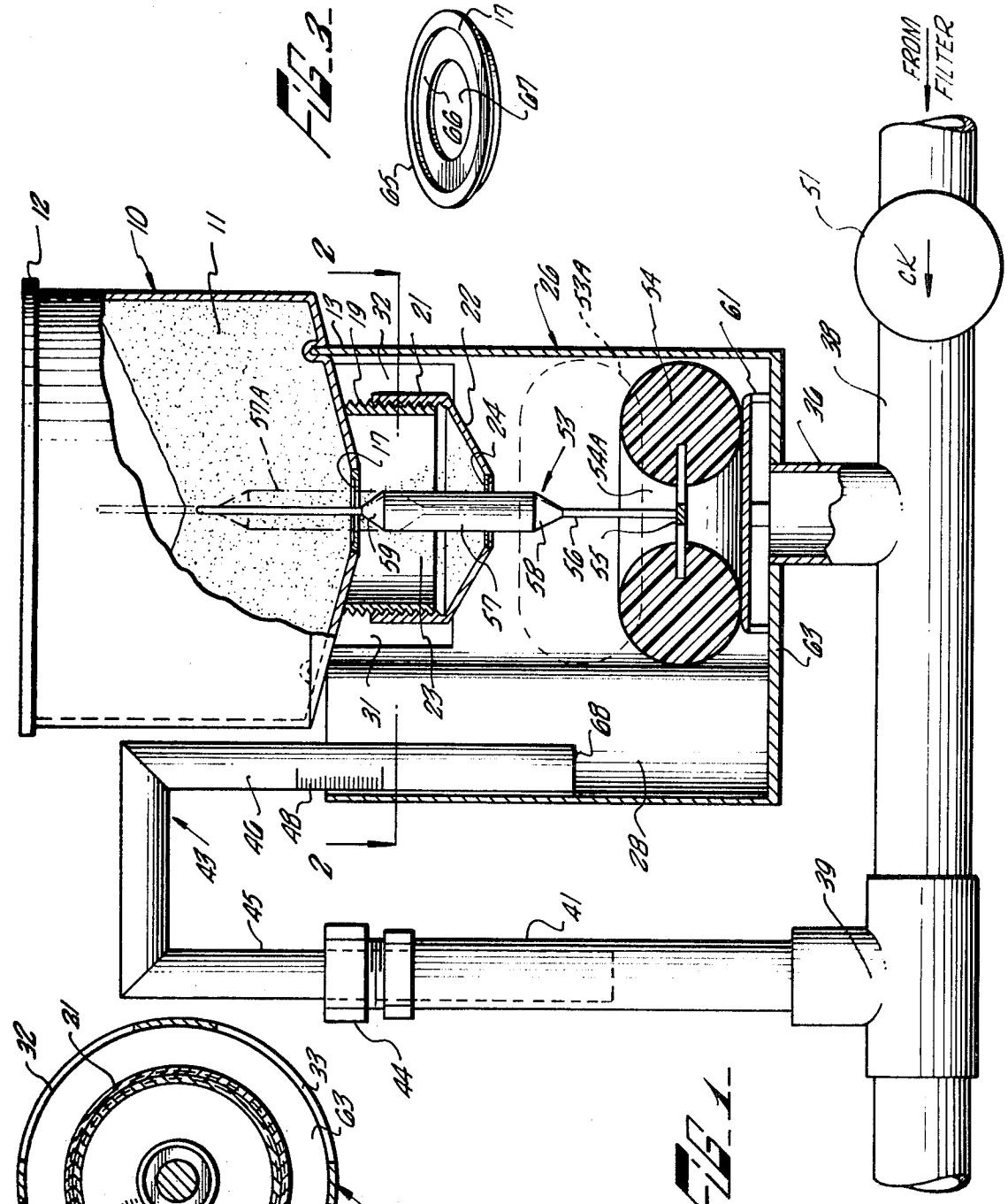


FIG. 1

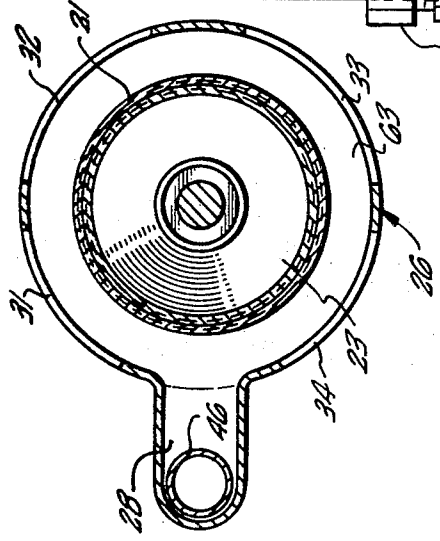
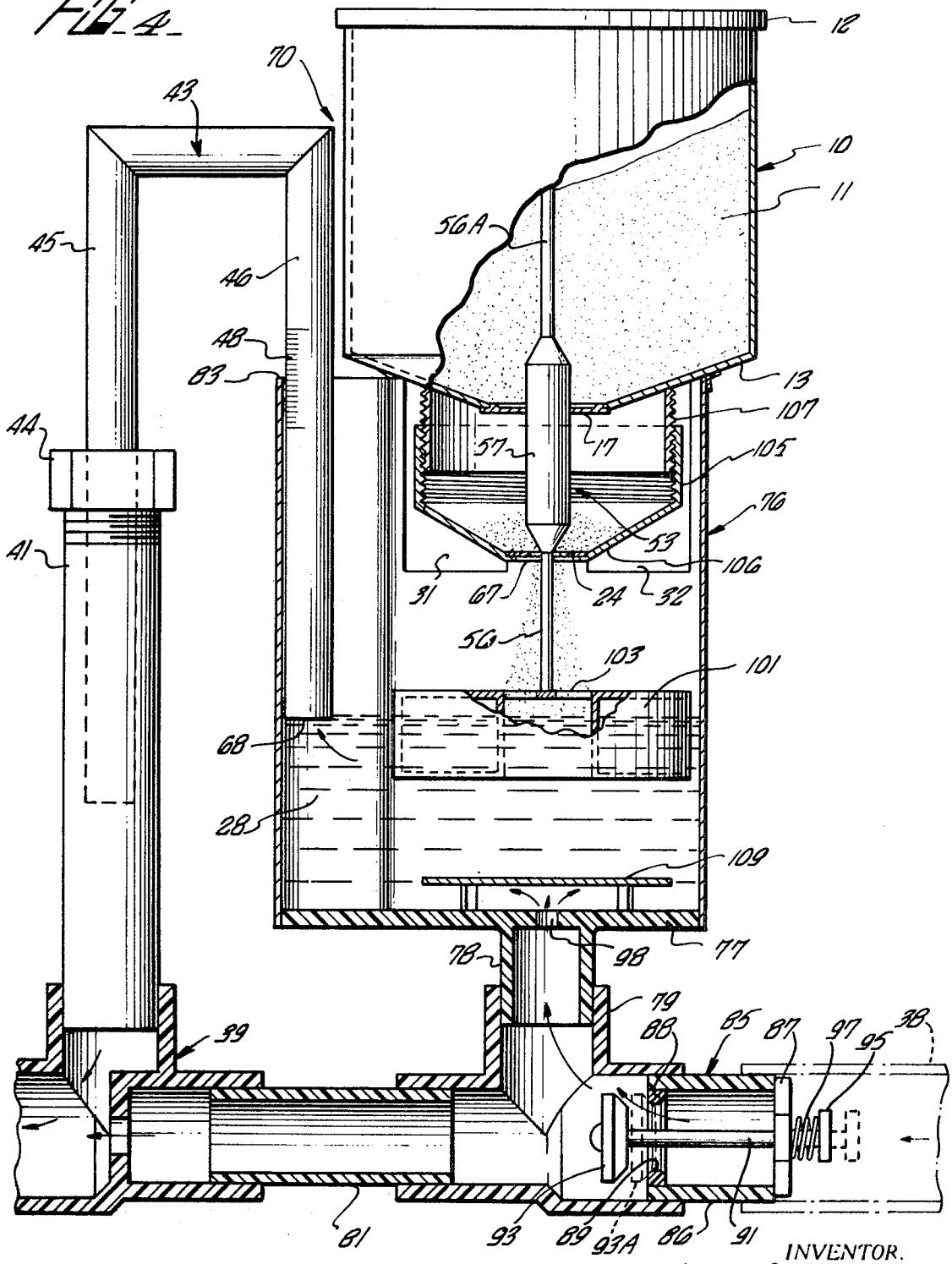


FIG. 2

FIG. 3

INVENTOR.
WALTER C. LORENZEN
BY
W. J. Gribble
ATTORNEY.

FIG. 4



INVENTOR.
WALTER C. LORENZEN

BY

W. J. Gribble
ATTORNEY.

FIG. 5

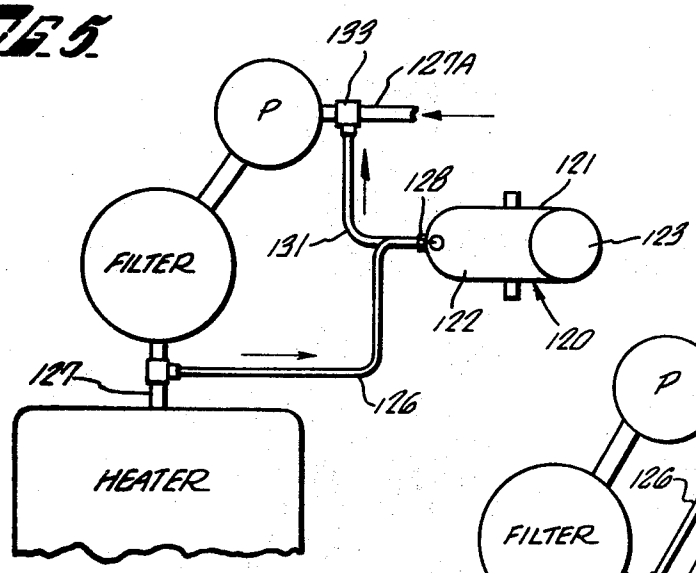
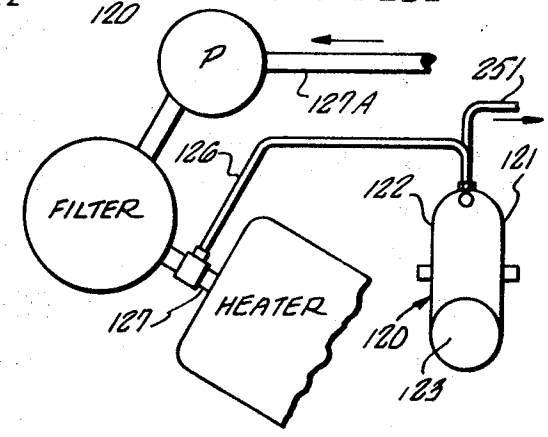


FIG. 9



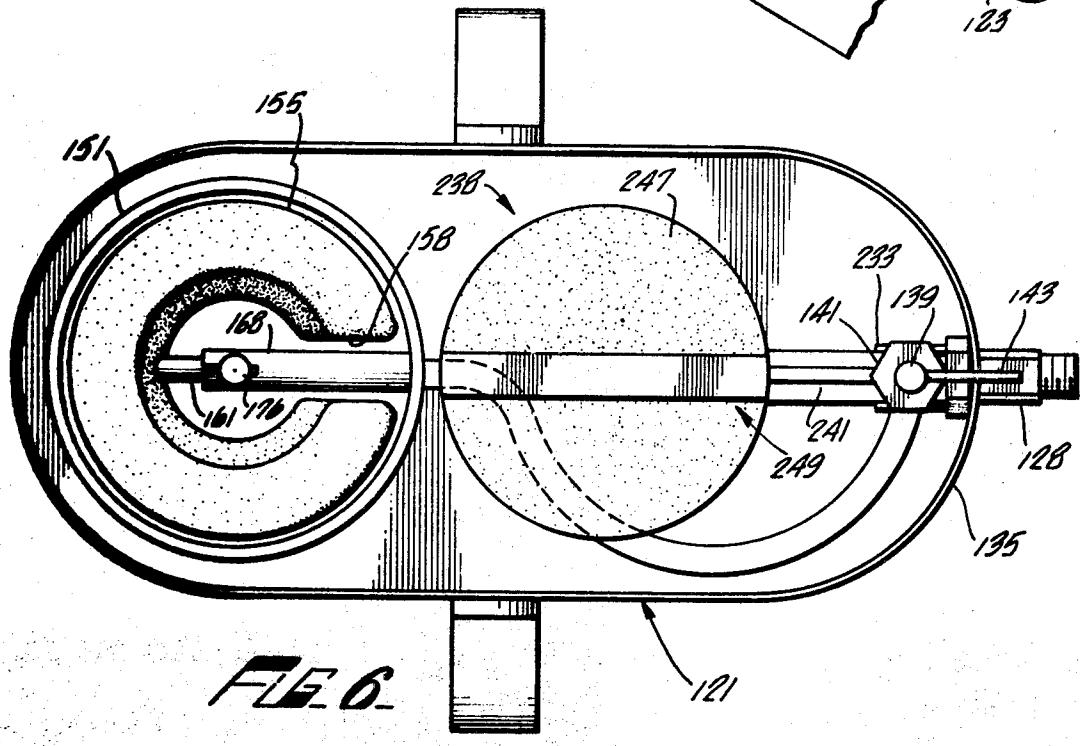


FIG. 6

INVENTOR:
WALTER C. LORENZEN

BY

W. J. Gribble
ATTORNEY

FIG 8

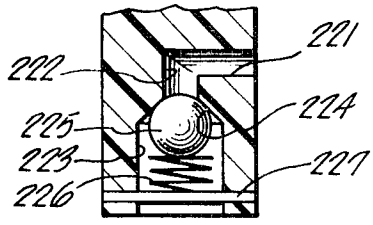


FIG 7

INVENTOR.
WALTER C. LORENZEN
BY
W. J. Gribble
ATTORNEY

SOLUBLE GRANULE FEEDERS

This application is a continuation in part of my copending application Ser. No. 809,605 now abandoned filed Mar. 21, 1969 and entitled "Soluble Granule Feeder."

BACKGROUND OF THE INVENTION

Chlorine and other chemicals are used in swimming pools to control growth of algae and other organisms in the pool water. The chlorine concentration level must be maintained in a range below the level harmful to pool users and above the minimum effective to eliminate the algae. Therefore, the amount of chlorine introduced into the pool should be relative to the amount of water circulating in the pool.

Conventionally measured amounts of chlorine are manually added at intervals to the pool water in the pool, which is periodically tested as to concentration level. Previous attempts to chlorinate pools automatically have been ineffective because the previous chlorinating apparatus had to be located in the pool water recirculation system such that concentrated chlorine passed through the pump, filter and heater with accumulative damage thereto. My invention enables the concentrated chlorine to be introduced after dilution into the circulation line to protect the vulnerable mechanical apparatus or to return to the pool independent of the pool water recirculating system.

SUMMARY OF THE INVENTION

The invention contemplates soluble granule feeders for use in a swimming pool or other liquid circulation system having a pump joined to suction and return flow lines. Each feeder comprises a mixing tank open to atmosphere and connected to a granule supply bin. A bypass conduit taps the return line to supply liquid from a portion of the return line flow to the mixing tank.

A metering cup having means for volumetric adjustment connects to the granule supply bin. Supply bin and cup have vertically aligned valve ports. A cylindrical valve member reciprocates in and out of the valve ports in response to a valve float in the tank, opening one valve port and closing the other as the pump cycles on and off, filling and emptying the mixing tank.

In one embodiment an educer tube includes means for adjusting the level of the tube entrance in the tank to control the water level to correlate with the volume of granules metered by the metering cup.

In another embodiment a first mixing tank receives the granules and determines a measured water amount to be mixed with the granules before the solution overflows into a second mixing tank.

The granule feeder of the invention thus introduces a measured volume of granules into a measured volume of water each time the pump cycles. In a swimming pool system the pump conventionally turns on or is turned on at the start of the day. Thus the soluble chlorine, for instance, is discharged into the mixing tank as the conduit conducts return line liquid from the pump to the tank, raising the valve float. The float movement opens the metering cup valve port and closes the bin valve port so that only granules from the cup enter the tank.

When the pump shuts off mixing tank water drains away, the valve positions reverse and the supply bin fills the closed metering cup to prepare for the next cycle.

These and other advantages of the invention are apparent from the following detailed description and drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic drawing, partly in section, of an embodiment of the invention;

FIG. 2 is a plan section taken along line 2—2 of FIG. 1;

FIG. 3 is a perspective view of a valve membrane;

FIG. 4 is an elevational view, partly in section, of an alternate embodiment of the invention;

FIG. 5 is a diagram of a circulation system combined with a further alternate embodiment of the invention;

FIG. 6 is a plan view of the embodiment of FIG. 5;

FIG. 7 is a sectional elevation of the embodiment of FIG. 5;

FIG. 8 is an enlarged sectional detail of an inlet valve; and

FIG. 9 is an alternate circulation diagram.

In the drawing like parts are given like reference characters.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiment of FIGS. 1–3 comprises a supply bin 10 for soluble chlorine granules 11 having a removable cap 12 and an inverted conical bottom 13. The granules partially fill the bin. Centrally of bottom 13 is a valve membrane 17. Concentric with the valve membrane and depending from the supply bin is an exteriorly threaded collar 19. An internally threaded sleeve 21 having an inverted conical bottom 22 is adjustably engaged with depending collar 19. The sleeve may be transparent or translucent. The collar and sleeve define an adjustable metering cup 23. Centrally of the floor 22 is a valve membrane 24.

Supply bin 10 rests upon a tank 26. The tank is largely cylindrical, may be of a transparent plastic material and includes a narrow vertical side chamber 28 extending from one side of the tank. In the upper portion of the tank are windows 31, 32, 33, 34 which open he tank to atmosphere.

A connecting conduit 36 extends from the bottom of the tank to a pool water return line 38. The pool return line extends from the swimming pool filter to the pool through a venturi unit 39.

A vertical pipe 41 extends upwardly from the venturi unit and receives a U-shaped educer tube 43 through a threaded connector 44. Tube 43 has a downward leg 45 extending into vertical pipe 41 and a downward leg 46 extending into chamber 28 of the tank. Leg 46 has a series of graduation marks 48 to calibrate the depth of penetration of the leg into the tank.

A check valve 51 in line 38 upstream of the tank conduit 36 prevents backflow from the tank to the filter, since the check valve closes when the pool supply pump stops and also keeps the filter from draining its liquid back into the pool through the suction line.

A float valve assembly 53 resides within the tank. The assembly may comprise a foam plastic float 54 having a spider 55 fixed to the float across float central opening 54A. A valve rod 56 extends upwardly from the spider into supply bin 10. Intermediate of the rod is a cylindrical valve member 57 having conical ends 58, 59 at the bottom and top of the member, respectively. The float rests upon a water permeable base 61 which rests upon a floor 63 of the tank.

As can be seen from FIG. 3, each valve membrane may comprise an annular amount 65 with a neoprene or rubber elastic membrane 66 fixed therein. The membrane has a central port 67 which is preferably slightly less in diameter than the outside diameter of valve member 57.

In FIG. 1 valve member 57 occupies the port in valve membrane 24, precluding any transfer of granules between the metering cup 23 and the interior of the tank. When the pump of the pool circulation system is started, water enters through the conduit 36, filling the tank and raising float assembly 53 to the level shown by the dotted lines 53A. Water flow through venturi unit 39 induces water flow up leg 46 of educer tube 43 and down through the venturi to the pool. The level to which liquid rises is controlled by positioning end 68 of the educer tube leg 46 as desired. The water level is changed by adjustment of leg 46 to correlate with the amount of dry chlorine in the metering cup.

When the tank fills sufficiently, valve member 57 rises through valve membrane 24 into valve membrane 17 in the position shown by dotted lines 57A. In this position port 67 of the valve membrane between the supply bin and the metering cup is closed, whereas the port of valve membrane 24 is open between the metering cup and the tank.

In the embodiment of FIG. 4 an automatic chlorinator assembly 70 comprises a supply bin 10 for soluble chlorine granules 11, a removable cap 12 and a conical bottom 13 and a substantially cylindrical mixing tank 76 upon which the bin

rests. The tank has a narrow vertical side chamber 28 at one side of the tank. A plurality of windows like windows 31, 32 of FIG. 4 opens the upper portion of the tank to atmosphere.

The mixing tank has a molded floor 77 from which a connecting conduit 78 extends to a molded Tee 79 fitted into a pool water return line 38 shown in broken lines. A short plastic nipple 81 connects Tee 79 with a venturi unit 39. The venturi unit connects to a line (not shown) extending to the pool.

A vertical pipe 41 extends upwardly from the venturi unit and receives a U-shaped educer tube 43. Educer tube 43 has a downward leg 45 which extends into vertical pipe 41 through a slip connector 44 and a second downward leg 46.

Educer tube leg 46 extends downwardly into vertical side chamber 28 of tank 76. Graduation markings 48 on leg 46 register with top 83 of the tank to permit accurate positioning of an outlet 68 of tube 46 to adjust the tank water level with respect to the rest of the components of the tank assembly.

Connecting Tee 79 receives a check valve assembly 85 in its upstream orifice. The check valve assembly comprises a tube 86 supporting a spider 87 and a valve collar 88 at opposite ends of the tube. Collar 88 has an annular valve port 89.

A valve stem 91 is slidably mounted in spider 87. One end of the stem supports a valve closure member 93 adapted to seal port 89. The other end of the stem has a restraining collar 95 which contains a compression spring 97 about the valve stem. The compression spring bears against spider 87, disposing the valve to close against port 89. The spring is calibrated to permit opening of the valve when line pressure in line 38 increases as the pool supply pump turns on. When the valve is closed, as shown by the dotted position 93A of the closure member, back flow from the mixing tank to the filter and other pool supply equipment is precluded, as is drainage from the filter through the suction line from pool to filter.

When the pool pump is turned on either manually or by automatic timing devices, a part of the flow from return line 38 passes upwardly through connecting conduit 78 and a metering port 98 into the bottom of tank 76. As the volume of water within the tank increases, an air-filled float member 101 rises in the tank, pushing upwardly a valve assembly 53 into the body of granules 11 in supply bin 10. The valve assembly comprises a rod 56 fixed to a spider 103 in the central orifice of the float and a cylindrical valving member 57 with conical ends on the rod. Rod 56 extends upwardly into the supply bin in an extension 56A which serves as a pilot guide for the valving member and tends to agitate the granules 11 within the supply bin.

Valve member 57 passes upwardly through a valving membrane 24 secured in the bottom of a transparent metering cup 105. The metering cup has a frustoconical bottom portion 106 and is threadably engaged with a metering cup collar 107 secured to the bottom of bin 10. Bin 10 has a valving membrane 17 centrally located in its sloping floor 13.

Each elastic valving membrane has a central opening 67 which has an inside diameter which is preferably slightly less than the outside diameter of valving membrane 57.

In operation the two illustrative embodiments are similar. Each is responsive to the on-off cycling of return line flow, which is conventionally induced by a pump. When liquid is forced through the line, most of the liquid surmounting the check valve continues on through the venturi unit to the pool or other usage site. A portion of the liquid is bypassed through the mixing tank. When the supply bin is filled and the float assembly at rest, the bin port is open so that the metering cup is filled from the bin. As liquid enters the mixing tank from the return line to float assembly rises, moving the valve ember with respect to the bin and cup valve ports.

When the water level reaches the intake of the educer tube of the float assembly is generally raised sufficiently so that the valve member closes the bin port and opens the metering cup port. The measured amount of soluble granule therefore traverses the cup port into the liquid in the mixing tank where it dissolves.

The concentrated solution is drawn through the educer tube by the action of the venturi unit to be further mixed with the liquid in the return line prior to reaching the pool or other useful repository. Flow continues through the mixing tank as long as flow continues in the return line, assuring complete transfer of the metered solubles from the tank. The tank itself is thereby spared the effects of long-term storage of a heavy chemical concentration.

When the pump or other impeller shuts down, flow in the return line ceases and the check valve closes. Liquid in the tank drains through bypass conduit 38 (or 78) to the return line and thence to the pool. Components of the circulating system upstream of the check valve do not drain, either by way of the return line or the pump suction line, as air cannot pass the check valve to permit reverse flow.

As liquid drains from the tank after pump shutoff, the float assembly lowers. Valve member 57 migrates through the valve membrane 17 into valve membrane 24. The effect of such migration is to open the port between the bin and cup just after closing the valve port between the metering cup and the mixing tank. Naturally, granules flow from the supply bin to the cup to charge the cup with another measured quantity available for mixing on the next pump cycle. No addition of granules to the tank takes place, as the metering cup port is closed.

Either of the metering cups may be adjusted volumetrically by turning the sleeve on the collar to change the space between the bin floor and the cup floor. The tank windows afford access to the sleeve.

As the metering cup capacity is changed, it may be desired to change the water level in the tank correlatively. The water level is adjusted by raising or lowering the educer tube in the slip connector on the vertical tube from the venturi unit. Graduations 48 on leg 46 of the educer tube may be coordinated with the thread lead on the metering cup sleeve to facilitate coordinated adjustment.

The embodiment of FIGS. 5–8 also has means for adjusting the supply of granules received in the metering cup and means to insure proper dilution of the chlorine solution before the solution enters the circulation system or pool.

Referring now to FIG. 5, a soluble granule feeder 120 has a mixing tank 121 with a cover 122 and a supply container 123, which is removably supported above the cover. A bypass line 126 connects from the pool recirculation line 127 to an inlet coupling 128 in an end of the tank. Preferably conduit 126 connects to the line 127 between the filter and the heater. The connection may be of the conventional type.

A return conduit 131 connects to a return line segment 127A between the pool and the pump with a conventional connector fitting 133.

FIG. 6 is a plan view of the feeder 120 with the top 122 removed and the feeder oppositely oriented from its position in FIG. 5, fitting 128 being at the right end in FIG. 6. FIGS. 6 and 7 both show a fitting 128 abutting a curving end wall 135 of the tank 121, to which it is held in sealed relationship by a nut 136 on a plastic tee 138 connecting through the wall to the fitting. A valve stem 139 resides vertically in the tee, being sealingly engaged with a conventional compression nut 141 at the top of the tee. The valve has an L-shaped port 142 coinciding with the entry path of fitting 128. A ball check valve assembly 143 in downward leg 144 of the tee prevents back flow. The handle 145 affords means for turning valve stem 139 to preclude flow from fitting 128 through port 142.

A flexible tube 146 is conventionally secured to tee 138 by a compression nut 147. The tube extends downwardly and leftwardly as shown in FIG. 7 within tank 121 and extends through the bottom portion of a cylindrical first mixing tank 150 which is sealed to the bottom of tank 121, in which solution is further mixed. The tube terminates in a flutter type or "duck bill" check valve 148.

A foam float 154 is movable within first mixing tank 150. The float is hollow, having a cylindrical outer wall 155 and a frustoconical inner wall 156. The float has a vertical aperture 158 which gives the float the appearance of a "C" in FIG. 6.

Near the bottom of the float a horizontal pin **161** extends radially from interior wall **156** and is fixed to a leg **162** which has a foot **163**. In FIG. **7** the foot rests upon the bottom of the tank, limiting the downward reciprocation of the foam float.

A guide rod **165** anchored in the wall **166** of first mixing tank **150** extends through the aperture **158** of the float. The rod extends radially and terminates near the center of the mixing tank in a slot **168** which guides a valve member **170**. The valve member comprises a vertical wire **172** anchored at its lower end in post **161** and leg **162** and carrying a cylindrical valve component **174**, which is preferably divided into an upper element **176** and a lower element **177**.

The mixing tank wall terminates in an upper edge **179** at a height below the tank top **122**.

A metering cup **181** is supported upon a cup receiver **182** which protrudes downwardly through top **122** into the second mixing tank **121**. Cup **181** and receiver **182** are substantially identical in configuration, each having an upper cylindrical portion **184**, a reduced diameter cylindrical wall **185** and a frustoconical wall **186** terminating downwardly in an opening **187**. The juncture of wall **184** and wall **185** defines a shoulder **189** which rests upon the top **122** of the tank **121** about a cylindrical aperture **191** in the tank. The cup and receiver are in substantial alignment with the first mixing tank such that the valve member is reciprocable both through downward opening **187** of the receiver and a metering cup valve port **193** at the bottom of the metering cup.

The receiver has a plurality of apertures **195** through which the mixing tanks communicate to atmosphere. The metering cup is devoid of such apertures.

An elastic or resilient valving membrane **197** is held in the bottom of the metering cup. The membrane is similar to the valve membrane **66** of the previously described embodiment. The diagram has a port aperture **198** which restricts about the valve member element **197** in FIG. **7**, precluding granule flow through the port.

Metering cup **181** supports a container adapter **201**. The adapter has a collar **202** which fits about the upper portion of the metering cup cylinder and has a reduced diameter portion defining a wall **204** which receives the inner cylinder of a neck **206** of a container **207**, shown fragmentarily.

The adapter **201** has an upper central orifice **208** in which an elastic valve membrane **210** seats. The membrane has a port aperture **211** to receive valve member element **176** in sealing relationship.

A downwardly depending boss **214** on the adapter receives externally a metering volume adjuster **215**. The volume adjuster has a first cylindrical chamber **217** and a larger second cylindrical chamber **218** and to which boss **214** fits.

The volume adjuster is capable of limiting the amount of granules received by the metering cup in a manner to be described later on.

Circulation through the chlorinator initiates from the bypass line **126** and passes through the valve stem **139** with its check valve assembly **143**. As can be seen from FIG. **8** the valve stem has a horizontal inlet passage **221** connecting to a vertical passage **222**. The vertical passage has a lower counterbore **223**, with a valve seat **224**, in which a check ball **225** and a compression spring **226** reside. A transverse pin **227** retains the spring and ball in the bore. The check valve precludes flow from the first mixing tank, and may replace the duck bill valve in the flexible tube **146**. The stem is easily removed to clear either of the passages, which are about 0.096 inches in diameter.

Return conduit **131** connects to the second mixing tank **121** by means of a conventional threaded coupler **231** which passes through the wall **135** of the tank **121** to threadably engage a float arm bracket **233** which is further held by a screw **234**. The coupler contains a check valve **236** allowing outward flow from the tank, but preventing input from conduit **131**. The check valve may vary in type but is shown as a "duck bill" type press-fitted in the coupler.

The coupler, sealed in the tank wall, provides a tank outlet. The outlet is valved by means of a float valve assembly **238** which responds to the liquid level in the second tank **121**. The assembly has a float arm **241** with a depending valve support finger **242** carrying a valve element **244** which seats against the inward face of coupler **231** to close the outlet when the valve arm is at its lowest position.

The end of the float arm remote from a pivot pin **246** which secures the arm to bracket **233** is fixed to a foam float **247**. The float arm has a ribbed area **249** into which the float **247** protrudes, although some interval may exist between the foam float and the arm surfaces between ribs. The interval provides a space into which weight material (not shown) may be injected to achieve the proper flotation response for the arm. Other means of achieving float performance are not precluded from the scope of the invention, the described apparatus being illustrative only.

Liquid enters the valve stem **139** and emerges in first mixing tank **150**, causing float **154** to rise from its foot **163**. As the float rises, say at the time the pool circulation pump is first turned on, valve component **174** also rises, changing the valving positions of elements **176** and **177** to shut off the supply bin port and open the port of the previously filled metering cup, transferring granules from the cup to the first mixing tank. The granules mix with the liquid flowing in the tank, and, as the liquid level rises, are carried over edge **179** in full or partial solution and into the volume defined by tank **121**, where further mixing takes place.

Valve float **247** responds to rising liquid in the second tank by actuating finger **242** to open coupler **231** so that liquid exits the chlorinator and flows to the pool. Flow may be by way of the pump circuit under pump suction, or, as illustrated in FIG. **9**, may be a separate line **251** to the pool, if the pool chlorinator is above pool level. Alternatively, conduit **131** may be linked to a venturi unit in the conventional pool return line, as in the previously described embodiment, such that flow from the second tank is educed by return line suction. The chlorinator of the invention is thus seen to be adaptable to either cross pump, downstream or separate return system.

Flow through the tanks continues as long as the pump is on and valve **139** is open. When the pump is off, flow ceases to the chlorinator, and the tanks drain until valve element **244** closes coupler **231**. A small drain aperture **253** in the wall of tank **150** provides means for the liquid level in the first mixing tank to lower such that the valve elements **176** and **177** are carried downwardly, closing the metering cup and opening the bin port. Granules then flow into the metering cup in an amount determined by the volume adjuster **215**. The cup without the adjuster on boss **214** may hold 5 ounces. A single adjuster may reduce the amount to 4 ounces as contact of the rising granule level with the adjuster closes the path to the cup. Since the valve element can migrate through the adjuster to close the bin port, the amount of granules in the metering cup remains as determined by the adjuster. Adjusters, of varying sizes, used in multiples, can thus set the cup measure as desired.

The illustrative embodiments described above do not exhaust the variations within the scope of the invention, and other variations in that scope will occur to those skilled in this art. It is therefore desired that the invention be measured by the appended claims.

I claim:

1. A soluble granule feeder for use in a liquid circulation system with a pump and suction and return lines, the feeder comprising a mixing tank, a bypass conduit joining the tank to the return line downstream of the pump, a venturi unit in the return line downstream of the bypass conduit, an educer tube connecting between the mixing tank and the venturi unit, a check valve between the bypass conduit and the pump, a supply bin for granules connecting to the tank, a metering cup between the bin and the tank, a bin valve port in the granule supply bin, a cup valve port in the metering cup, a float in the mixing tank; a valve member adapted alternately to open and close the cup and bin ports, the cup port being open when the bin port is closed and the bin port being open when the cup

port is closed; means fixing the valve member to the float such that the float lifts the valve member through the valve ports when the pump turns on so that granules in the metering cup move through the cup port into the mixing tank and so that the bin port is closed, and such that the float lowers the valve member through the valve ports when the pump shuts off so that the cup port is closed and the bin port is open so that the granules from the bin fill the metering cup; the educer tube being positioned within the mixing tank such that liquid flows through the tank so long as the pump delivers liquid to the return line.

2. Apparatus in accordance with claim 1 wherein the metering cup comprises a threaded collar depending from the supply bin about the bin port, a sleeve threadably engaged with the collar, and a floor on the sleeve sloping downwardly to the aforesaid cup port.

3. Apparatus in accordance with claim 1 further comprising means for changing the position of the educer tube within the mixing tank to vary the liquid level in the tank when the pump is on.

4. Apparatus in accordance with claim 1 wherein the check valve comprises a plumbing tee connecting to the bypass conduit, a sleeve tube in the tee, a valve wall in the tube transversely thereof, an annular wall in the valve wall defining a valve port, a support spider in the tube remote from the valve wall, a valve stem supported in cantilever fashion from the spider, a valve closure member on the stem remote from the spider and separated therefrom by the valve wall and adapted to close the valve port, a stop on the valve stem, the spider being interposed between the valve wall and the stop, and a compression spring between the spider and the stop urging the valve closure member into closed relationship to the valve port.

5. In a soluble granule feeder having a mixing tank and inlet and outlet liquid lines, the combination comprising a granule supply bin, a metering cup between the bin and the tank, a bin valve port, a cup port in the metering cup, a float in the mixing tank responsive to liquid level in the tank, and a valve member operative by the float alternately to open and to close the cup valve port and the bin valve port by raising and lowering the valve member into and out of bin and cup ports in response to the liquid level of the mixing tank, said metering cup having a frustoconical floor sloping to the cup valve port.

6. A soluble granule feeder for use in a liquid circulation system with a pump and suction and return lines, the feeder comprising a mixing tank, a bypass conduit joining the tank to the circulation line downstream of the pump, means connecting the feeder to a return line to the pool, a check valve between the tank and the pump, a supply bin for granules connecting to the tank, a metering cup between the bin and the tank, a bin valve port in the granule supply bin, a cup valve port in the metering cup, a float in the mixing tank; a valve member adapted alternately to open and close the cup and bin ports, the cup port being open when the bin port is closed and the bin port being open when the cup port is closed; means fixing the valve member to the float such that the float lifts the valve member through the valve ports when the pump turns on so that granules in the metering cup move through the cup port into the mixing tank and so that the bin port is closed, and such that the float lowers the valve member through the valve ports when the pump shuts off so that the cup port is closed and the bin port is open so that the granules from the bin fill the metering cup.

7. Apparatus in accordance with claim 6 wherein the metering cup comprises a threaded collar depending from the supply bin about the bin port, a sleeve threadably engaged with the collar, and a floor on the sleeve sloping downwardly to the aforesaid cup port.

8. Apparatus in accordance with claim 6 wherein the metering cup comprises a first cylindrical chamber, a second frustoconical chamber, a valve port at the minimum diameter of the second chamber, and a resilient transverse membrane at the port adapted to sealingly receive said valve member.

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