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Richards

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[54] **PRESSURE-TYPE TABLET HYPOCHLORINATING DEVICE**

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[51] **Int. Cl.** **B01d 11/02**

[58] **Field of Search** ..... 23/267 E, 272.7, 272.8; 137/268; 210/169; 239/310, 317

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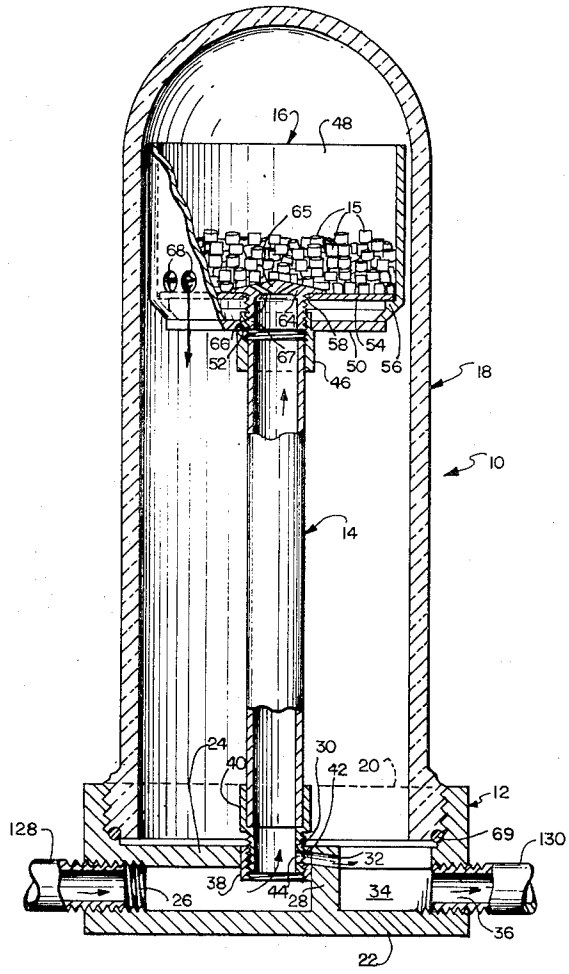
[57] **ABSTRACT**

A water chlorinating apparatus adapted to be connected to a pipe having water flowing therethrough under pressure of up to 100 lbs/sq. inch including valves and conduits for diverting a portion of the water flow into the chlorinating unit containing the chlorinating material and for conducting chlorinated water back to the pipe. The chlorinating unit comprises a base having an inlet and an outlet, an upstanding tube communicating with the inlet and a container, the container having a lower surface supporting the chlorinating tablets and a plurality of orifices in the container wall just above the lower surface and communicating with the outlet. A distributor head in the container directs streams of water flowing from the upstanding tube into contact with the tablets resting on the lower surface adjacent the orifices to dissolve the tablets. A weir is located in the base of the unit for diverting the water flow to the tablets, the weir having an adjustable by-pass orifice for varying the dosage of hypochlorite. A drain pipe and valve are provided to allow replenishment of the tablets without interruption of the water flow in the pipe.

10 Claims, 2 Drawing Figures



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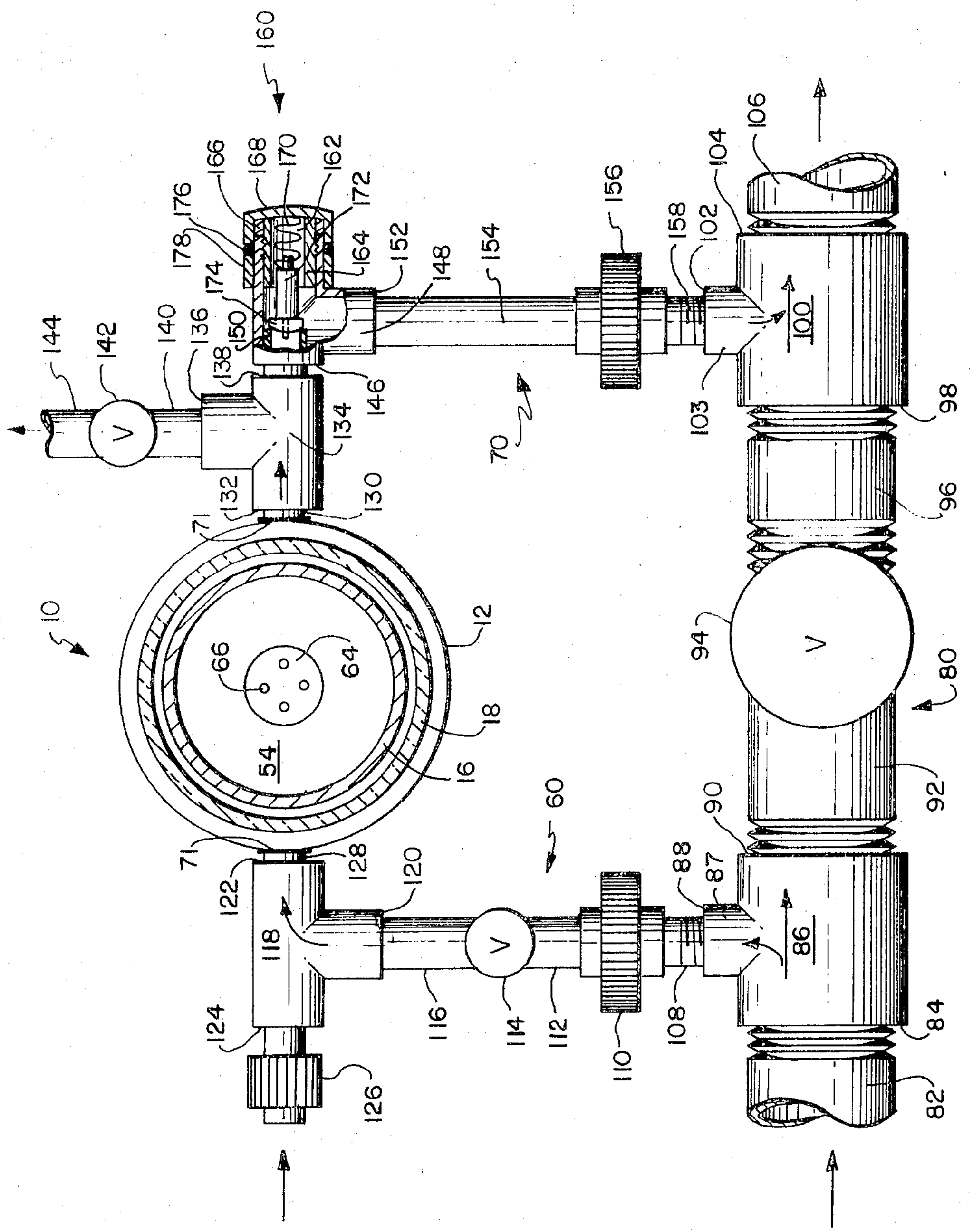

FIG. 1

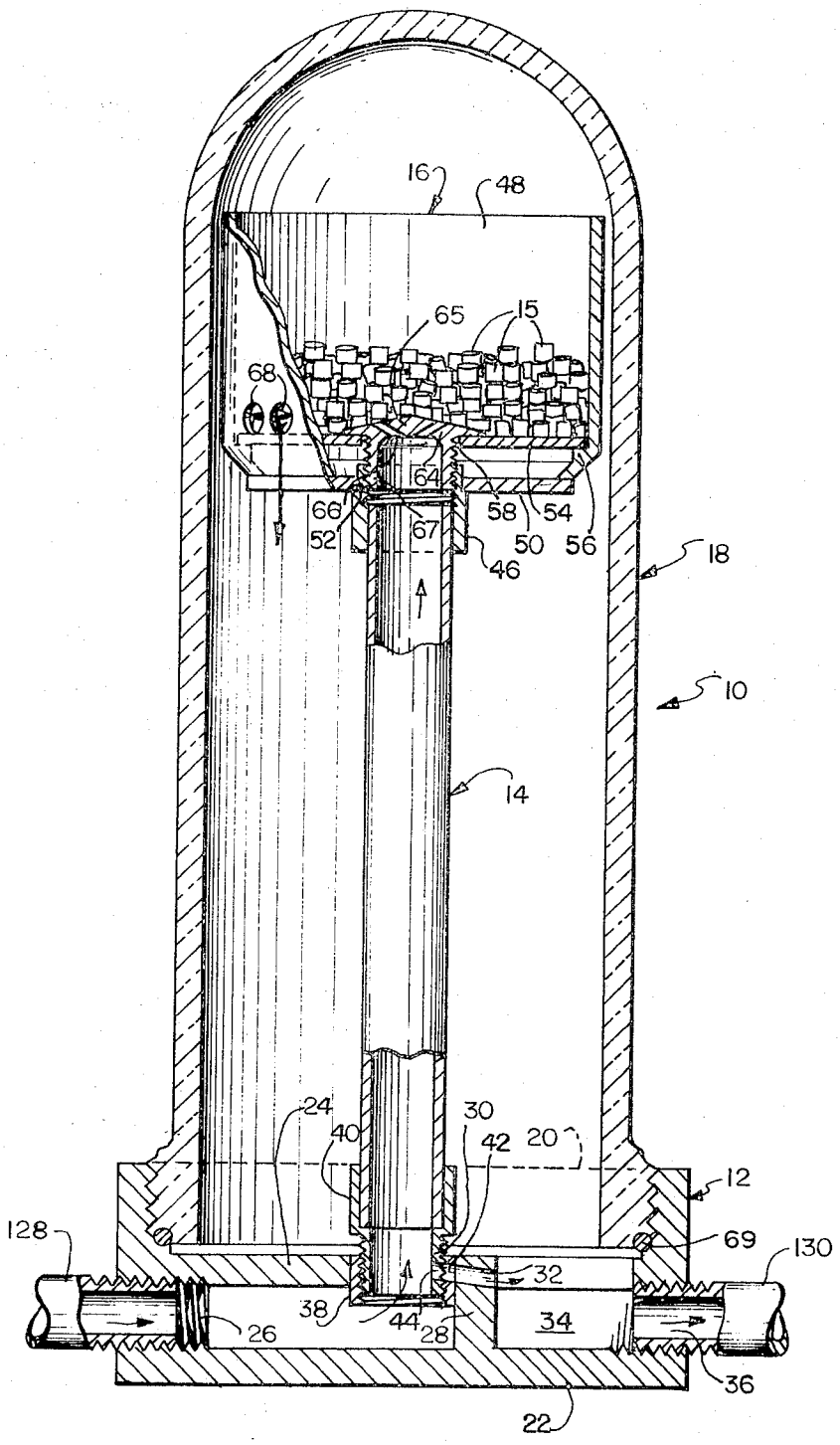
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FIG. 2

PRESSURE-TYPE TABLET HYPOCHLORINATING DEVICE

This invention relates to a unit for chlorinating water flowing under a pressure of up to 100 lbs./sq. inch in a pipe. More particularly, this invention relates to a new and improved chlorinating unit using a hypochlorite supply, in tablet form, wherein the tablets are gradually dissolved to provide a hypochlorite solution to water flowing in a pipe.

It has been found desirable to chlorinate water flowing in a water pipe under pressure for reasons of sanitation and to prevent the water from becoming contaminated and diseased. In the past there have been certain proposals and devices which were intended to accomplish the same functions as that of the present invention, but in actual practice, such devices and proposals were found to be unsatisfactory. Such prior devices for providing hypochlorite in tablet form to water pipes resulted in a loss of water pressure in the flow and the added necessity of using power-operated pumps to compensate for the pressure loss. Additionally, such prior devices and proposals were characterized by difficulties in adjusting hypochlorite dosages as required by variations in flow without frequent manual adjustment and were characterized by a clogging of the system's lines by lime deposits. Also, some of the systems necessitated a frequent replenishment of the tablets and an interruption of the flow of the water during such replenishment.

With the foregoing in mind, it is, therefore, a primary object of the present invention to overcome the difficulties and deficiencies associated with the prior art units of this type, and to provide a new and improved unit for chlorinating water flowing in a water pipe or main.

Another object of the present invention is to provide a chlorinating unit which operates reliably and allows the dosage of hypochlorite to be easily and accurately adjusted so that it automatically provides the desired dosage at variable rates of water flow.

Another object of the present invention is to provide a chlorinating unit capable of chlorinating a flow of water within a water pipe under high pressure.

Another object of the present invention is to provide a chlorinating unit capable of providing hypochlorite solution to water flowing in a pipe without a substantial loss of pressure and without the additional use of an auxiliary pump.

Another object of the present invention is to provide a chlorinating unit wherein the chlorine tablets can be replenished or the unit serviced without interrupting the flow of water in the pipe.

Other objects, advantages and salient features of the present invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment thereof.

In general, the invention resides in a new and improved chlorinating unit adapted to be interconnected to a pipe or high-pressure water main through which water is flowing. A first conduit carries a portion of the water from the water main into a container in the unit which carries the hypochlorite tablets. In the container the water dissolves the tablets to form a chlorinated solution. A second conduit carries the chlorinated solution from the container back to the water main. A valve is located in the water main between the connection with the main of the first and second conduits for diverting a portion of the water flow into the unit. The chlorinating unit, which is interposed between the first and second conduits, is comprised of a base, an upstanding tube, a container for the tablets, and a plastic dome mounted to the base and enclosing the tube and the container. An inlet bore within the base communicates with the first conduit and the upstanding tube and allows water entering the unit to flow through the tube and into contact with the tablets in the container to dissolve a portion of them to form the chlorinated solution. A discharge chamber within the base communicates with orifices in the container wall and the second conduit and receives the chlorinated solution exiting from the orifices. A weir is located at one end of the inlet bore to divert the flow of water entering the inlet bore to the upstanding tube. An adjustable bypass orifice is located in the weir to vary the hypochlorite dosage by allowing some of the water flowing into the upstanding tube to flow directly into the discharge chamber without contacting the tablets. Referring now to the drawings which form a part of this original disclosure:

FIG. 1 is a top plan view, partially in section, of a chlorinating unit in accordance with the principles of the present invention, shown connected to a high-pressure water main; and

FIG. 2 is an elevational view, partially in section, of the chlorinating unit.

Referring now to the drawings, as seen in FIG. 1, the chlorinating unit **10** is connected to the high pressure water main **80** by an inflow first conduit **60** and a return flow second conduit **70**. The water flowing in the water main **80** approaches the region of the chlorinating unit **10** along the pipe **82**, which is connected to the inlet **84** in a first reducing tee fitting **86** having a branch **87** with an outlet **88** to the first conduit **60** and an outlet **90** to a short pipe **92**, which leads to a valve **94**. The other side of the valve **94** is connected to another short pipe **96** which is connected to an inlet **98** in a second expanding fitting tee **100**, having an inlet **102** in the branch **103** receiving the second conduit **70** and an outlet **104** to a pipe **106** in the water main **80**.

The first conduit **60** is comprised of a pipe **108** communicating with the first outlet **88** in the first tee **86**, a union **110** between the pipe **108** and the pipe **112**, a stopcock valve **114** between pipes **112** and **116**, and a third tee fitting **118**. This tee fitting has three openings, **120**, **122** and **124**, with opening **120** communicating with the pipe **116**, opening **124** communicating with a tractor tire valve **126**, and opening **122** communicating with a male adaptor pipe **128** which fits into an inlet **26** in the chlorinating unit **10**.

An outlet **36** in the chlorinating unit **10** is fitted with a male adaptor pipe **130** which connects with an inlet **132** in a fourth tee fitting **134** having two outlets, **136** and **138**. The outlet **136** is connected through a pipe **140** to a stopcock valve **142** which is further connected to a drain pipe **144**. The outlet **138** in the fourth tee **134** is connected to an inlet **146** in a fifth tee fitting **148** through a male adaptor pipe **150**. An outlet **152** in the fifth tee **148** is connected to a pipe **154** which is in turn connected to a union **156** and a pipe **158** which communicates with the inlet **103** in the second tee **100** in the water main **80**. The water main **80** leaves the region of the chlorinating unit via pipe **106** which is connected to the outlet **104** in the second tee **100**.

A non-return valve **160** is formed in the second conduit **70** by providing a spring biased plug over the open end of the male adaptor pipe **150** in the fifth tee **148**, which open end is beveled to form a valve seat. The tee **148** has threads on the interior surface at its end near outlet **162** for the reception of a short tube **164** threaded at its mid-portion and having reduced diameter end portions. The outer end portion has a bushing **166** welded around it, the end portion and the bushing being covered by a cap **168** welded thereto. Supported on the inside of the cap is a stainless steel spring **170** which is connected to a perspex rod **172** which has an enlarged plug or half round rubber tap washer **174** fitted on its reduced end which is biased into a covering engagement with the beveled opening in the male adaptor pipe **150**. The valve is made water-tight by providing an O-ring **176** between the rim of the cap **168** and a sleeve **178** welded to the surface of the fith tee **148**

As seen in FIG. **2**, the chlorinating unit **10** consists of a base **12**, an upstanding tube **14**, a container **16** and a transparent plastic dome **18** oriented in an upright position. The container **16** carries a supply of hypochlorite tablets **15**.

The base **12** which is formed from a suitable plastic material, non-reactive with a hypochlorite solution, is essentially a right cylinder having an open top end **20** and a closed bottom end **22**. The upper portion of the interior cylindrical surface of the base wall is threaded for receiving corresponding threads on the outside of the bottom of the dome or accumulator **18**. Extending vertically from the closed end **22** to immediately below the threaded portion of the base is a raised portion or land **24** filling only a portion of the enclosed volume of the cylindrical base **12**. A cylindrical inlet bore **26** passes perpendicularly through the exterior cylindrical surface of the base **12** and through the land **24**, terminating short of an end wall or weir **28** in the land. The top of the land **24** has a vertically formed, cylindrical bore **30** therein adjacent to the weir and communicating with the inlet bore **26**, which vertical bore is substantially along the longitudinal axis of the cylindrical base **12**.

Passing through the weir **28**, substantially prallel to the plane of the closed end **22** of the base and having one end communicating with the vertical bore **30**, is a by-pass orifice **32** which has its other end communicating with a discharge chamber **34** located on the opposite side of the weir from the inlet bore **26**. The discharge chamber **34** communicates with a cylindrical outlet bore **36** in the exterior cylindrical surface of the cylindrical base **12**, which outlet is diametrically opposed to the inlet bore **26**.

Welded within the vertical bore **30** is a short pipe or sleeve **38** having threads on the inside surface thereof corresponding to and receiving threads on the exterior surface of a short tube or polyvinyl chloride male adaptor **40**. An aperture **42** in the wall of the tube **40** and an aperture **44** in the wall of the sleeve **38** are provided to coincide with the by-pass orifice **32** in the weir **28**. A rotation of the tube **40** relative to the sleeve **38** can increase or decrease the effective cross-sectional area of the by-pass orifice **32**.

The upper portion of the wall of the short tube **40** is reduced in thickness to form a shoulder for the reception of one end of the upstanding tube **14**, preferably formed from polyvinyl chloride. The other end of the tube **14** is fitted snugly into the lower portion of the inside of a short tube or polyvinyl chloride female adaptor **46** which has threads along the interior of a reduced diameter upper portion thereof.

The container **16** is preferably formed from plastic material, such as that sold under the trademark "Perpex" which is an acrylic plastic consisting essentially of polymerized methyl methacrylate. The container **16** is essentially a right cylinder having an open end **48** and a closed end **50** having a central bore **52** therein which receives the reduced diameter portion of the tube **46**. Hence, the container **16** rests on the shoulder formed by the reduced diameter portion of the tube **46**. A support surface **54** in the form of an annulus with an outer diameter substantially equal to the diameter of the container **16** is supported above the bottom end **50** on a circular shoulder **56** located within the container **16** along the inner perimeter thereof. The tablets **15** rest on this support surface **54**, which can be formed of the same material as that of the container **16**.

A distributor head **64** for the unit is formed by a conical portion **65** which is disposed above the support surface **54** and a depending tube portion **67** which projects through a central aperture in the support surface **54**. The depending tube portion **67** has external threads corresponding to and engaging the interior threads of the tube **52**. A series of bores **66** are provided in the conical section **65** of the distributor head **64**, which bores communicate with the interior of the tubular portion **67**. The base of the conical element **64** lies on the support surface **54**. Angularly spaced along the container wall and in substantially the same horizontal plane as the head **64** are a plurality of elongated orifices **68** which are located with their lowermost portions at the top of the support surface **54**.

Completely enclosing the container **16**, the upstanding tube **14**, the land **24**, and the discharge chamber **34** is the dome or accumulator **18** made from transparent plastic and mounted to the base at its bottom by a threaded connection. That connection is made water-tight by the use of an O-ring **69**.

The outer portion of the inlet bore **26** in the base **12** is threaded to receive the male adaptor **128** which is also connected to opening **122** in the third tee **118**. Similarly, the outer portion of the outlet bore **36** is threaded to receive a male adaptor **130** which also fits into the fourth tee **134**. Both connections have O-rings **71** for providing a fluid-tight connection.

In operation, hypochlorite tablets **15** are placed in the container **16** covering the lower support surface **54**. The by-pass orifice **32** is adjusted to provide for flow therethrough by rotating the tube **40** carrying an aperture **44** relative to the tube **38** carrying the aperture **42**, to thus achieve the desired effective cross-section of and flow rate through the by-pass orifice **32**. Then the plastic dome or accumulator **18** is placed over the container **16** and screwed on to the base **12** with an O-ring **69** making the connection liquid and airtight.

The valve **94** in the water main **80** is initially in a fully open position and valve **114** in the first conduit **60** is in a fully closed position. The valve **142** leading to the drain pipe **144** is additionally in a fully closed position.

With water flowing through the water main **80** under pressure, the valve **114** is gradually opened. This gradual opening prevents the possibility of a surge of water from entering the chlorinating unit **10**. When valve **114** is fully opened, the valve **94** is gradually closed to divert a portion of the water flow through pipe **82** into

the first conduit **60**. The water not diverted continues through the valve **94** and into the second tee **100**.

The water that flows through the first conduit enters the inlet bore **26** in the base **12** and flows therethrough until it contacts the weir **28**, at which time it is diverted upwards into the upstanding tube **14**. A portion of the water in the tube **14** flows through apertures **42** and **44** and the by-pass orifice **32** and directly into the discharge chamber **34**. Another portion of the water flows up the tube **14** and into the orifices **66** located in the distributor head **64**. The water flowing therethrough is directed from the bores **66** into contact with the hypochlorite tablets **15** located adjacent the orifices **68** on the support surface **54** in the container **16**. The contact of the water with the tablets lying lowermost in the container results in a dissolving of a portion of the tablets, such dissolved portion being carried by the water out of the container **16** through the orifices **68**. The undissolved tablets located immediately above the dissolving tablets continuously move downwards and occupy the space above the support surface vacated by the dissolved tablets.

After the chlorinated solution exits through the orifices **68**, it flows downward under the force of gravity and accumulates in the discharge chamber **34** and the dome **18**. Here he chlorinated solution is diluted by mixing with the water passing directly into the discharge chamber **34** from the inlet bore **26** via the by-pass orifice **32**. This dilute chlorinated solution then flows out the outlet bore **36** in the base **12** into the second conduit **70** and back into the water main **80** through the second tee **100** and the pipe **106**. In this manner, the chlorinated solution is further diluted in the second tee **100** as it mixes with the undiverted portion of the water flowing through the valve **94** and entering the second tee **100**. The non-return valve **160** in the fifth tee **148** prevents a backflow of water from the water main **80** into the chlorinating unit **10**.

Since the unit **10** is pressurized by the dome **18**, a certain amount of air is trapped in the dome. This air usually has enough pressure to prevent a build-up of water in the dome to a height which would submerge the tablets in the container **16**. If the pressure is not sufficient, additional air can be pumped into the dome via the valve **126** in the third tee **118**.

The water flowing in the pipe **106** and leaving the region of the chlorinating unit is tested to determine the hypochlorite concentration in order that the dosage of hypochlorite may be adjusted in the chlorinating unit **10**.

This adjustment may be accomplished in two alternative ways. The first way is by manipulating the valve **94** to cause more or less water to flow into the chlorinating unit **10** from the water main **80**, and to concommitantly dissolve more or less of the tablets. The second way is to vary the cross-sectional area of the by-pass orifice **32**. This is accomplished by closing the valve **114**, opening the valve **142**, removing the dome **18**, and rotating the tube **40** relative to the sleeve **38**. This rotation moves the aperture **44** in the tube **40** relative to the aperture **42** in the sleeve **38**. This reduces or increases the cross-sectional area of the by-pass orifice **32**. A larger cross-sectional area allows more water to flow therethrough and less to proceed up the upstanding tube **14** to dissolve tablets, and therefore a smaller dosage is provided. If the by-pass orifice is made smaller in cross-section, then more water flows up the tube **14** and dissolves more of the tablets, therefore providing an increase in the concentration of the hypochlorite solution delivered from the chlorinating unit **10** to the water main **80**.

In order to replenish the supply of hypochlorite tablets in the container **16**, the valve **114** in the first conduit **60** is closed and the valve **142** leading to the drain pipe **144** is opened. This allows all of the fluid in the chlorinating unit **10** to flow out the drain pipe **144** and to reduce the pressure in the dome. The non-return valve **160** prevents a flow of water from the water main **80** from reaching the chlorinating unit **10**. The dome is removed and additional tablets **15** are placed in the container **16**. This replenishment as outlined above is performed without interrupting the flow of water in the water main **80**.

Lime deposits can be removed from the apparatus by opening the valve **142** to release the pressure in the unit, which also flushes out some of the lime, and by removing the non-return valve **160** by screwing off the cap **168**, at which time the lime deposits may be physically removed.

Utilizing an apparatus described above, 5000 gallons of water can be chlorinated per charge at 60 pounds/-square inch of pressure without the need for additional air being pumped into the dome. And 200,000 gallons of water can be chlorinated per charge at 100 pounds/-square inch of pressure with the assistance of air being pumped into the dome. It has also been determined that a flow of as low as 2 gallons of water per minute can be chlorinated at 1 part per million.

While one advantageous embodiment has been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

I claim:

1. An apparatus for chlorinating water, the combination comprising;

a pipe means adapted to have water flowing under pressure therein;

a chlorinating unit containing hypochlorite tablets;

a first conduit means for conducting water from said pipe means to said chlorinating unit;

a second conduit means for conducting a chlorinated solution of water from said unit to said pipe means;

a valve means in said pipe means for diverting a portion of said water flow into said first conduit means;

said chlorinating unit including

a container means for supporting said tablets,

a base, having an inlet bore communicating with said first conduit and an outlet bore communicating with said second conduit,

a tube means centrally carried by said base and communicating with said inlet bore in said base and said container means for conducting water from said inlet bore to said container means and supporting said container a substantial distance above said base.

a conical distribute means, mounted at one end of said tube means and located within said container means, for directing water flowing up said tube means into contact with said tablets,

a plurality of orifices located in said container means adjacent the bottom thereof and in sub-

stantially the same horizontal plane as said distributor means, and

dome means removably mounted to said base and enclosing said tube means and said container means for pressurizing said chlorinating unit;

said apparatus being operative so that water is diverted into said container means from said pipe means along said first conduit, said inlet bore and said tube means by operation of said valve means and such water contacts and dissolves said tablets forming a chlorinated solution which solution flows through said orifices, through said outlet, said second conduit and back into said pipe means,

said container means being formed as a right cylinder having an open end at the top and a closed end at the bottom, said closed end having a central bore therein receiving said tube means, and

said container means further including an annular support surface which is solid and flat and is supported above said closed end, said support surface supporting said tablets said orifices being located in the side of said container means above said annular support surface.

2. An apparatus according to claim **1** and further including

a weir located in said base for diverting the water flow from said inlet bore to said tube means.

3. An apparatus according to claim **2** and further including

a by-pass orifice means in said weir communicating at one end with said tube means and at the other end with said outlet, allowing water to flow from said inlet and out said outlet without traveling through said container means for varying the amount of hypochlorite dissolved.

4. An apparatus according to claim **3** and further including means for varying the cross-sectional area of said by-pass orifice means in said weir for further varying the dosage of hypochlorite.

5. An apparatus according to claim **4** and further including means for introducing pressurized air into said unit to prevent the tablets from bein submerged.

6. A chlorinating unit operative, upon coupling to a source of water flowing under pressure in a pipe, to chlorinate the water in the pipe, said unit comprising;

a container means for supporting hypchlorite tablets;

a base, having an inlet communicating with said pipe and an outlet communicating with said pipe;

a tube means centrally carried by said base and having one end communicating with said base and the other end communicating with said container means for conducting water from said inlet to said container means and supporting said container a substantial distance above said base.

a conical distributor means connected to said tube means at its other end fordirecting water into contact with said tablets;

a plurality of orifices located in said container means adjacent the bottom thereof and in substantially the same horizontal plane as said distributor means;

dome means mounted to said base and enclosing said tube means and said container means for pressurizing the unit;

weir means located in said base for diverting water flow from said inlet into said tube means; and

a by-pass orifice means located in said weir means for conducting water from said tube means directly into said outlet;

said unit being operative so that water flowing from said pipe into said inlet strikes said weir means and is diverted into said tube means, a first portion thereof flowing through said by-pass orifice means and out said outlet and a second portion thereof flowing through said tube means and said distributor means into contact with and dissolving said tablets, said second portion then flowing through said orifices and out said outlet, both of said portions returning to said pipe,

said container means being formed as a right cylinder having an open end at the top and a closed end at the bottom, said closed end having a central bore therein receiving said tube means, and

said container means further including an annular support surface which is solid and flat and is supported above said closed end, said support surface supporting said tablets, said orifices being located in the side of said container means above said annular support surface.

7. A unit according to claim **6** and further including means for varying the cross-sectional area of said by-pass orifice means for varying the dosage of hypochlorite.

8. A unit according to claim **7** and further including

a land located in said base carrying said inlet bore,

a vertical bore in said land adjacent said weir means

wherein said means for varying the cross-sectional area of said by-pass orifice means includes

a sleeve rigidly connected to the wall of said bore and having an aperture therein coinciding with said by-pass orifice means,

a tube rotatably received in said sleeve and having an aperture therein coinciding with said aperture in said sleeve, wherein rotation of said tube moves the aperture therein relative to the aperture in said tube.

9. An apparatus according to claim **1**, wherein said distributor means includes a conical portion disposed above said support surface and a depending tube portion projecting through said annular support surface.

10. An apparatus according to claim **9**, wherein

said base has a cylindrical surface and a land and a weir therein,

said inlet bore passes perpendicularly through the exterior of said cylindrical surface through said land and terminates short of said weir,

said tube means communicates with said inlet bore via a cylindrical bore formed in said land, the axis of said cylindrical bore being perpendicular to the axis of said inlet bore, and said dome means is spaced from said container means.

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