March 4, 1969 V. L. HUNSAKER 3,430,823

LIQUID DISPENSING SYSTEM

Original Filed Aug. 17, 1966

Figure 1

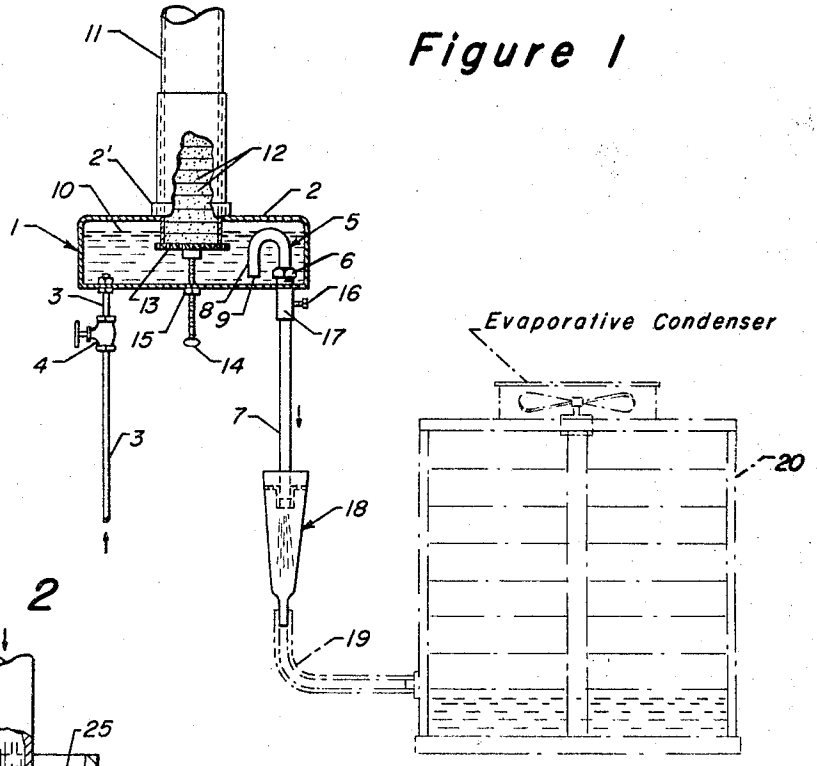


Figure 2

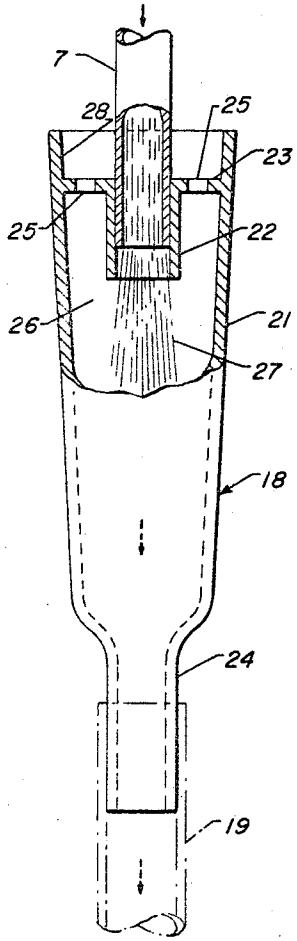
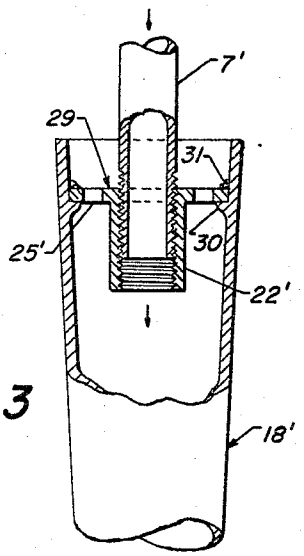


Figure 3



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LIQUID DISPENSING SYSTEM

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U.S. Cl. 222—416 5 Claims

Int. Cl. B67d *3/00;* F16l *43/00;* E03c *1/08*

ABSTRACT OF THE DISCLOSURE

In a liquid dispensing apparatus providing automatic intermittent discharge of a treated water stream including a water chamber, a water inlet line thereto, and a discharge line comprising an upper siphon section within the chamber and a lower externally depending vertical outlet leg, the combination therewith of an enlarged vertically positioned air inlet-vent section connected to said outlet leg, the air inlet-vent section having an enlarged central portion with a lower liquid outlet and an axially positioned upper liquid inlet depending a short distance through an upper horizontal diaphragm and into the hollow interior portion of the air inlet-vent section, the diaphragm having a plurality of small peripherally spaced ports around the liquid inlet. The air inlet-vent section precludes a vacuum in the water chamber of the dispensing apparatus or, alternatively, precludes any blow-back or backing-up of liquid into the siphon outlet in the event of a pressure increase on the system.

This application is a continuation of application Ser. No. 573,046, filed Aug. 17, 1966, now abandoned.

The present invention relates to an improved form of liquid dispensing system providing for an automatic intermittent discharge of a treated water stream, or other liquid, for use as an additive to recirculating water systems and the like. More specifically, there is provided a liquid dispensing arrangement that utilizes a siphon as part of a liquid outlet means to effect the intermittent fluid discharge therefrom and, in addition, combines therewith a special air inlet-vent section which precludes both vacuum and liquid "blow-back" problems with respect to the outlet means from the tank portion of the unit. Stated another way, there is provided a flow breaker arrangement on the discharge leg of a siphon outlet which will preclude a vacuum on the tank portion of the dispensing system by virtue of ports built into the flow breaker means or, alternatively, there is a preclusion of any blow-back or backing-up of liquid into the siphon outlet and into the dispensing apparatus by virtue of the same open ports that will serve as liquid or air outlet means to divert any reversing of liquid flow back into the tank portion of the system.

Many of the usual or conventional forms of liquid dispensing devices are employed to provide automatic feeding of dry chemicals to various types of water systems, as for example, in connection with boilers, cooling towers, heat exchangers, evaporative condensers, etc. Thus, small quantities of dissolved chemical compounds may be continuously added to a given water system (or other circulating liquid system) so as to prevent the formation of certain minerals which tend to form scale or cause corrosion. Chemical addition is also carried out to preclude the undesirable accumulation and growth of biological organisms, such as algae and slimes that may interfere with water circulation and heat transfer. The chemical may be in various dried forms or shapes, including briquettes and the like, such that there is the desired slow dissolving and gradual feeding of the particular solid material into a water stream and reservoir of the dispenser system which is in turn fed into a circulating water system which needs treating.

For slow controlled flows into a recirculating water system, it is not uncommon to use a siphon form of liquid outlet in connection with the discharge portion of the unit such that there is an intermittent or batch type of discharge from the tank portion of the apparatus; however, there can be various operational problems encountered when discharging into certain types of water systems. For instance, when feeding into an evaporative condenser tank there may be either a vacuum condition or a pressure condition acting upon the discharge line from the liquid dispensing system, depending upon the type of fan or blower equipment used with the evaporative condenser. In other words, the fan equipment for the evaporative condenser may be such that it blows air down over the condenser coils in a manner to cause a certain amount of pressure within the condenser tank and in turn cause blow-back problems on the treated water stream from the dispensing unit. Alternatively, the fan arrangement may be of an air suction type with respect to the evaporative condenser tank causing a less than atmospheric pressure therein and a vacuum condition on the treated water line from the liquid dispensing system. In the latter case, there can be a sustained suction in the dissolving chamber of the unit and a disruption of the desired intermittent liquid flow therefrom, as provided by the normal operation of the siphon means.

It may therefore be considered a principal object of the present invention to provide a liquid dispensing system having a siphon arrangement in connection with the treated water outlet therefrom as well as provide air inlet-vent flow breaking means in combination with the outlet leg of such siphon arrangement so as to preclude either a vacuum or blow-back condition within the liquid dispensing chamber.

It may also be considered an object of the present invention to provide as the flow breaking means in combination with the siphon outlet arrangement of the dispenser system a special form of enlarged air inlet-vent section whereby there is insured a desired free-fall of liquid from the outlet leg of the siphon means, while, in addition, there is provided open port means suitable for either air intake or air-liquid discharge as effective in breaking undesired vacuum or pressure conditions in the outlet conduit downstream from the discharge leg of the siphon arrangement.

In a broad aspect, the present invention provides an improved liquid dispensing system which combines means to preclude both vacuum and liquid blow-back problems with respect to the outlet means thereof, with such system

comprising in combination, a water chamber, a water inlet conduit to such chamber, a water outlet means from such chamber including a siphon section with a short leg portion in combination with the latter and adapted to be primed with a rising liquid level in said chamber, whereby the water level is caused to rise and fall in the chamber and intermittently discharge a liquid stream thereform, said water outlet means and siphon section further having an externally depending conduit section of sufficient length to provide siphoning from said chamber and including an enlarged vertically positioned air inlet-vent section, the latter having an upper liquid inlet and lower liquid outlet and in addition an enlarged central portion with open port means to the exterior thereof whereby a free-fall of siphoned liquid is insured and whereby air may be pulled in and fluid expelled to maintain a normal descending liquid stream flow, and support means above the bottom of said chamber for holding a column of material thereabove whereby the lower portion of such material is in intermittent contact with the water in the chamber to provide an additive thereto.

It is realized that various forms of flow breaking sections may be utilized in combination with siphon discharge arrangements, however, the preferred form provides for an elongated depending enlarged section so as to permit the free-fall of the liquid stream from the outlet leg of the siphon means and at the same time provide for air inlet-vent means within an upper peripheral plane such that the intake of air in breaking a vacuum will not materially change the normal flow of the liquid discharge from the depending siphon leg. An upper peripheral arrangement of air ports also permits a more or less "in line" flow of air or liquid in the reverse upstream flow by virtue of any of any back-flow conditions that may temporarily exist from pressure within a tank to which a treated liquid discharge line may lead.

Reference to the accompanying drawing and the following description thereof will serve to more clearly illustrate the operation and advantages of the improved liquid dispensing system as well as point out the design and arrangement of a preferred form of vent or flow breaking section for use in combination with the liquid dispensing system.

FIGURE 1 of the drawing indicates diagrammatically the overall liquid dispensing system including a siphon discharge means from a dissolving chamber and an air inlet-vent section in combination with the siphon discharge leg whereby vacuum or pressure problems within a particular liquid circulating system will lead to no effect on the additive liquid dispensing system.

FIGURE 2 of the drawing indicates in a partial section and in an enlarged view one form of air inlet-vent section for use in combination with the discharge leg of a siphon outlet means.

FIGURE 3 shows a modification in the construction and assembly of the section shown in FIGURE 2.

Referring now particularly to FIGURE 1 of the drawing, there is indicated a liquid dispenser unit **1** having tank or dissolving chamber **2** adapted to receive water or other liquid by way of an inlet line **3** with control valve **4**. The present embodiment indicates that the inlet line **3** enters the lower portion of the tank **2**, however, such inlet may be at a side or at the top of the tank in any convenient location which will permit a steady liquid inlet flow to the interior of the tank portion **2**. For simplicity, a bent tube siphon outlet arrangement **5** is shown as providing the liquid outlet means with the chamber **2**. The siphon **5** is also shown passing through a suitable packed collar arrangement **6** and as having a discharge leg **7** depending from the chamber **2**. Internally, a short intake leg **8** is positioned such that an open inlet end **9** is spaced a short distance above the bottom of the tank portion **2**. It will thus be seen that the water, or other liquid **10**, inside the tank **2** will intermittently rise and fall by virtue of the action of the siphon form of outlet means **5**. With a steady water inlet flow through line **3** and valve **4**, the water level **10** will rise to a point where it primes the inverted U portion of the siphon **5** and causes a descending flow in leg **7** to provide a suction on the inlet leg **8** and in turn lower the level of liquid **10** in the tank **2**. Of course, the piping or tubing for the siphon section **5** shall be of a larger diameter than the water inlet line **3** whereby there may be a relatively rapid discharge of the liquid from the tank **2**. Also, since the rate of discharge is rapid, the control of the overall rate of dispensing liquid from the tank or chamber **2** of the system will be effected by the rate of flow of liquid from line **3** and valve **4**.

In order that the liquid dispensing system operate as a chemical treatment apparatus, there is provision made in combination with the tank **2** to have a holder means, such as collar **2'**, for a container means **11** to hold suitable solid treating material **12**. In the present embodiment, the latter is indicated as being supplied as a series of stacked chemical briquettes which are in the container means **11** and resting on a suitable perforate plate or screen **13**. The latter in turn may be adjustably held in position by a threaded rod **14** extending through an internally threaded hub section **15** on the lower section of tank **2**. Thus, it will be seen that by adjusting the height of perforate plate member **13** there is in turn an adjustment for the vertical positioning of the stack of briquettes **12** and a corresponding control of the immersion depth of such dry chemical feed material into the liquid **10** that periodically rises and falls in dissolving chamber **2**. As an alternative arrangement for varying the height of the liquid level **10** in tank **2** and the amount of immersion of the lower extremity of the column of chemical compounds or briquettes **12**, there may be an adjustment of the height of the inverted U portion of the siphon means **5** at the outlet of the tank **2**. In other words, by suitable clamp means such as **16** on sleeve arrangement **17** there may be a vertical adjustment of the siphon and a corresponding adjustment of the upper liquid level **10** in the tank **2**.

It is of course not intended within the scope of the present invention to be limited to any one form of adjustment means for the liquid level within tank means **2** or to provide any one method of holding the briquettes or other physical form of chemical compound in superposed relationship with respect to the tank means. For convenience the chemical may be supplied in containers such as tubes **11** whereby there can be various particular sequential arrangements of briquettes of varying chemical compounds in order to provide desired chemical balance in treating the water flow from the tank **2** and the resulting control of water systems being treated by the discharge therefrom. It will be seen that as a lower briquette dissolves, the one immediately above will drop allowing the process to continue automatically. At such time as the briquettes **12** are substantially exhausted from the tubular holder **11**, there may be a change of holders with a new supply of briquettes or the addition of a new series of briquettes **12** into the vertically superposed holder **11**.

It is not intended to limit the present invention to any one type of holder or method of feeding the dry materials to the tank means **2** nor, in this instance, to the use of any particular types of chemical compounds. Generally, the briquettes, will comprise combinations of sequestrants such as polyphosphates, organic dispersives such as water soluble tannin extracts and alkalinity control agents which may include both acidic and basic compounds.

In addition there will be included in certain briquettes, or as separate briquettes, corrosion inhibiting chemicals and biocidal agents that are generally essential for treating water systems.

In accordance with the particular feature of the present improved dispensing system, there is indicated in combination with the outlet leg **7** and siphon means **5** a suitable vent or flow-breaker section **18**. The latter is in turn diagrammatically indicated as connecting through line **19**

to an evaporative condenser tank although it may connect to a cooling tower basin or such other unit which maintains a recirculating water system that needs to be treated by the liquid dispenser system. As better shown in FIGURE 2 of the drawing, one preferred form of the vent and flow-breaker section **18** is an elongated tapered cylindrical design, having a tapering or reducing diameter wall section **21**, an internal liquid inlet section **22** depending from a perforate diaphragm section **23** and a fluid outlet portion **24**. The latter is adapted to connect with any suitable outlet tubing or conduit such as **19** which carries the treated liquid stream to a particular circulating liquid system. The water inlet section **22** is axially positioned and is adapted to connect with discharge leg **7** of the siphon means **5**, such as shown in FIGURE 1 of the drawing. In the present instance, the internal periphery of section **22** provides a slip-fit for the end of pipe leg **7**, however, where desired there may be a threaded or solvent weld connection between the two sections in order to provide a more positive form of connection.

It will be noted that the upper diaphragm **23** is provided with a plurality of spaced holes **25** such that air may be vented therethrough or, alternatively, air induced into the interior portion **26** of the flow-breaker section. In a normal operation, there will be the intermittent gravity flow of treated liquid **27** from the lower end of leg **7** and inlet means **22** as the siphon section **5** serves to periodically discharge the liquid **10** from tank portion **2**, as shown in FIGURE 1 of the drawing. Also, under normal operating conditions, there will be substantially no air flow or liquid flow through any of the ports or openings **25** in diaphragm **23** as the intermittent treated liquid discharge takes place in the system; however, whenever there is an upset at the discharge end of the conduit **19** which leads to the evaporative condenser, or other processing equipment, there may be a corrective action with respect to the outlet means of the dispensing system. In other words, in the event of a vacuum condition existing on line **19** to tank **20**, there will be an intake of air through port holes **25** rather than a continuing suction effect or vacuum on the depending pipe leg **7** and on the liquid **10** within tank **2**. The continuing vacuum effect from siphon means **5** would preclude the liquid level **10** rising to its normal position and obtaining the needed immersion of the lower briquette **12**.

Alternatively, in the event of a superatmospheric pressure condition existing in equipment **20** and causing a flow-back of liquid through line **19** into the interior zone **26** of venting or flow-breaker section **18**, there will be a relief of such pressure backup by an outward flow of air or liquid, or both, through port means **25** to the atmosphere and the elimination of any damaging effect on the siphoning action of leg **7** and the desired liquid discharge action. The circumferential placement of holes **25** around depending siphon leg **7** and inlet means **22** provides for a uniform intake of air on the occasion of the vacuum condition or, alternatively, a uniform discharge of back pressure around stream **27** and around liquid inlet means **22** such that there is substantially no disruption of such flow **27** out of the siphon leg **7**. Still further, it has been found that the slightly tapering configuration of housing **21**, with the air ports **25** surrounding the axis of the inlet at a spaced vertical distance above outlet means **24**, permits a uniform peripheral dissipation of any back pressure or upstream flow of liquid in a flow that is generally cylindrical and only slightly off center with respect to outlet port nozzle **24**.

Preferably for a discharge line of approximately ½" internal diameter at leg **7** or at line **19**, there shall be of the order of 4" to 5" of vertical space **26**, varying from about 1½" to 1" diameter, within the tapered cylindrical section **21** in order to preclude turbulence and to provide sufficient free-fall of liquid **27** from the internal discharge of inlet means **22** to the outlet nozzle **24**. A shorter space does not adequately permit the dissipation of a back-flow problem without substantial disruption of the descending incoming liquid **27**. While, in addition, a shorter internal space **26** might lead to a complete filling of such space with liquid as it flows from the depending leg **7** and a back pressure condition from line **19** may be continued to be exerted upwardly through the section **26** into the depending leg **7** and into the reservoir tank **2** of the dispensing unit.

An alternative design and assembly may provide a separate insert for the interior of the flow-breaker section. For example, as best shown in FIGURE 3 of the drawing, there is shown a separate piece **29** resting on a shoulder **30** of the upper wall portion of a section **18'**. This permits easier less costly construction of the total unit by virtue of the separate fabrication of each element. Holes **25'** can be uniformly spaced in the horizontal portion as shown in section **23** of FIGURE 2. In the present embodiment, the interior of nozzle section **22'** is threaded to accommodate a threaded end on leg **7'** rather than a slip fit. Also, for assembly purposes the shoulder **30** can be internally positioned or recessed to provide a proper recessing of the diaphragm **29** and holes **25'** below the top end of the unit. After placement, the diaphragm **29** can be readily glued or solvent welded at **31** to insure the tight assembly of section **29** with section **18'**.

It may be specifically pointed out that in a preferred embodiment of this portion of the unit, there is a lowering or recessing of diaphragm **23** or **29** so as to provide a small liquid trap or "bubble zone." In other words, such as is shown in FIGURE 2, there can be a certain amount of liquid-air bubbling within the well or recess formed by an upper wall section **28** above ports **25** and a subsequent draining back of any liquid through such ports **25**.

I claim as my invention:

1. In combination with a recirculating water system which may be subject to vacuum or pressure conditions, an improved liquid dispensing apparatus having its outlet means connecting to such system and providing for intermittent liquid discharge thereto in a manner precluding both vacuum and fluid blow-back problems with respect to the operation of the dispensing apparatus, and such apparatus comprising in combination, a water chamber, a water inlet conduit to such chamber, a water outlet means from such chamber to said system including a siphon section with a short leg portion in combination with the latter and adapted to be primed with a rising liquid level in said chamber, whereby the water level is caused to rise and fall in said water chamber and intermittently discharge a liquid stream therefrom, said water outlet means and siphon section further having an externally depending conduit section of sufficient length to provide siphoning from said water chamber and including an enlarged vertically positioned air inlet-vent section having an upper liquid inlet and lower liquid outlet and in addition an enlarged central portion with upper positioned open port means to the exterior thereof whereby a free-fall of siphoned liquid is insured and whereby air may be pulled in and fluid expelled to maintain a normal descending liquid stream flow, and support means above the bottom of said chamber for holding a column of material thereabove whereby the lower portion of such material is in intermittent contact with the water in the chamber to provide an additive thereto.

2. The apparatus of claim **1** further characterized in that said vertically positioned air inlet-vent section has a tapering tubular wall portion with a decreasing cross-sectional area in the downstream direction.

3. The apparatus of claim **1** further characterized in that said air inlet-vent section has an axially positioned upper liquid inlet which depends a short distance through an upper horizontal diaphragm and into a hollow interior portion of such section to provide an annular section within the upper zone thereof, and said open port means comprises a plurality of small openings spaced

around upper portion of said annular section to communicate with the exterior of the air inlet-outlet section.

4. The apparatus of claim 3 still further characterized in that said plurality of small openings are positioned through said upper horizontal diaphragm.

5. The apparatus of claim 3 still further characterized in that said upper horizontal diaphragm is recessed from the top end of said air inlet-vent section with an open-topped wall portion therearound and has uniformly spaced ports therethrough, providing a resulting temporary liquid collection zone.

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U.S. Cl. X.R.

137—268; 239—428.5