No. 866.065. PATENTED SEPT. 17, 1907.

A. PRIESTMAN.

APPARATUS FOR CONTROLLING THE FLOW OF LIQUIDS.

APPLICATION FILED JUNE 25, 1906.

2 SHEETS—SHEET 1.

Fig. 2.

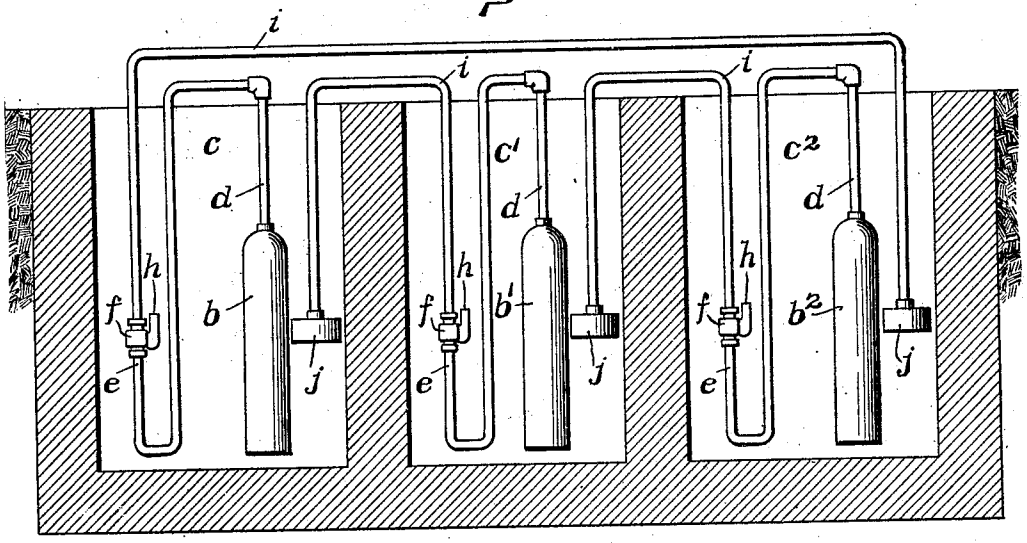
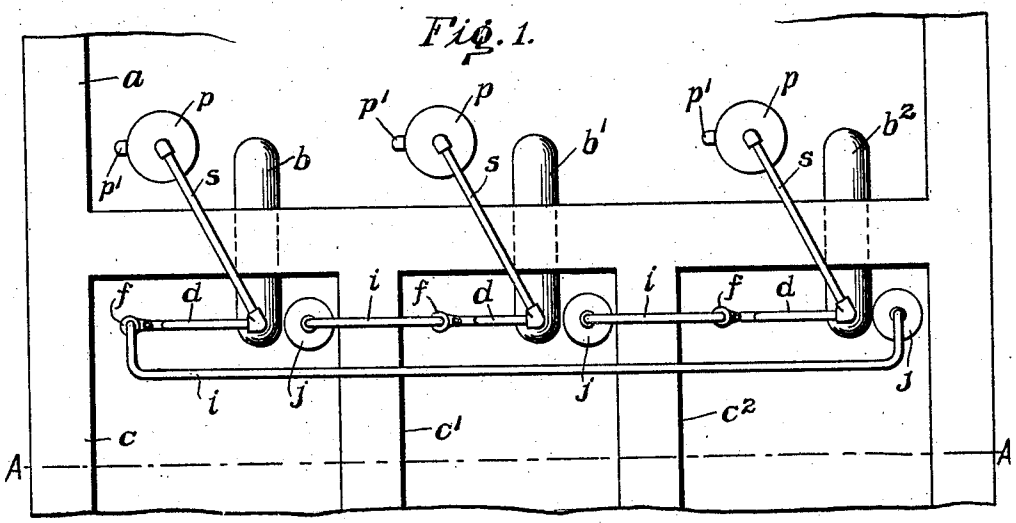


Fig. 1.



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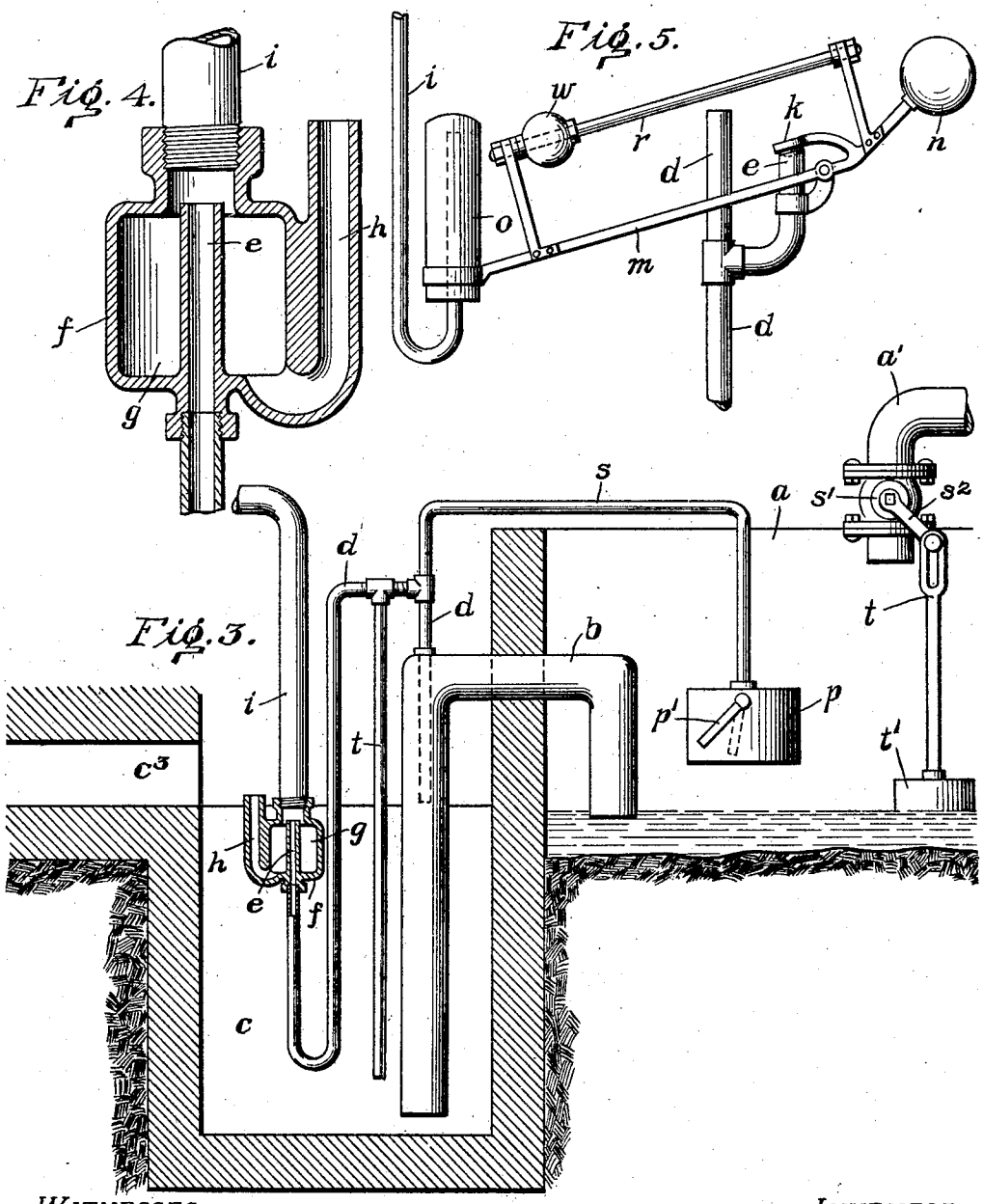

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UNITED STATES PATENT OFFICE.

ALBERT PRIESTMAN, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR CONTROLLING THE FLOW OF LIQUIDS.

No. 866,065. Specification of Letters Patent. Patented Sept. 17, 1907.

Application filed June 25, 1906. Serial No. 323,186.

To all whom it may concern:

Be it known that I, ALBERT PRIESTMAN, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Apparatus for Controlling the Flow of Liquids, of which the following is a specification.

My invention relates to that class of apparatus in which liquid is discharged by siphonic action from a common tank or reservoir through a series of siphons in succession, and is particularly adapted to systems of treating sewage in which the sewage is discharged from a common "dosing" tank to a series of contact beds, or the like, in succession. In such apparatus the liquid is discharged through sealed siphons when the hydrostatic head due to level of the liquid in the dosing tank is sufficient to force the seal. It is necessary, therefore, to insure the flow through any particular siphon, that the seal of that siphon should be weaker than the seal of the other siphons in the series; and, to cause the flow through the siphons in succession, it is necessary that their seals should be weakened in succession and that any weakened seal should be immediately strengthened or restored when that siphon has discharged. My improvements relate particularly to the means for thus automatically weakening the seal of one siphon and strengthening the seal of the previously weakened siphon.

In carrying out my invention I effect the weakening of any siphon by means acting during the flow of another siphon in the series, and strengthen or restore the seal of the weakened siphon by means acting during the discharge of such weakened siphon. Each strengthened siphon having the siphon of its seal thus restored by its own flow remains strengthened until its seal is weakened by the discharge of the siphon next in advance in the cycle of operations. The means which I prefer to employ for thus controlling the strength of the seals of the siphons consists of a valve in the seal pipe, which may be either a liquid valve, or a positive mechanical valve, and acts to maintain the seal of full strength in the seal pipe, and is opened or released to weaken the seal by means, such as an air bell and air pipe, controlled by the liquid discharged by another siphon. This valve of the liquid seal pipe is automatically restored or closed by the liquid discharged through its siphon to restore the full or strengthened seal, which will remain thus strengthened until the valve is again opened or released by the action of the liquid discharging again through the same siphon which operated it before.

My invention also relates to means for controlling at will the volume discharged from the tank upon the operation of any of the siphons, without affecting their automatic action or the cycle of their operations. This part of the invention relates to means for forcing air into the siphon to hold back the liquid in the shorter leg until a higher level is attained in the tank, than would otherwise be necessary to force the weakened seal. This part of my invention also embraces the use of an air relief pipe to prevent the forcing of such an excess of air into the siphon as would result in breaking the seal before it has been weakened to put the siphon in condition to operate.

My invention also relates to means for automatically controlling the supply of liquid to the distributing tank by the level of the liquid therein to prevent the prolongation of the action of any siphon by reason of an excessive supply to the tank.

In the drawings, Figure 1 is a plan view of a liquid distributing apparatus embodying my invention; Fig. 2 is a vertical sectional view of the same on the line A—A of Fig. 1; Fig. 3 is a transverse vertical sectional view enlarged of one of the distributing siphons of the form shown in Figs. 1 and 2 with the addition of means for controlling the volume of liquid discharged by any siphon from the distributing tank; Fig. 4 is a vertical section enlarged of one form of automatic valve for controlling the siphonic action, and Fig. 5 is a side elevation of another form of automatic valve for the same purpose.

a is the main distributing tank from which the liquid is discharged intermittently through siphons, as b b' b^2, in succession. In a system for treating sewage the tank *a* would usually be supplied from a main septic tank through a supply pipe or main a' (Fig. 3), and the distributing siphons b, b' &c. would each discharge to a separate contact bed through a chamber or tank c c' &c. The siphons b b' &c. are arranged each with the short intake leg in the main distributing tank *a*, and the long discharge leg in the tank or chamber c, c' &c. The long discharge leg of each siphon is provided with an air-lock seal pipe *d* leading from the siphon and terminating in a U-shaped seal *e* the open end of which is arranged near the level of the outlet c^3 of the tank or chamber *c* (Fig. 3). The open end of this seal *e* is controlled by an automatic valve which is in turn controlled by the level of the liquid in another tank or chamber c c' &c. of the series. The object of this automatic valve is to strengthen the seal of the pipe *d* when the valve is closed and to weaken the seal when the valve is opened. The result of this arrangement is, that, while the automatic valve in the end of the seal *e* remains closed the air-lock seal of that siphon will be strengthened to such extent that the liquid in the tank *a* will not force that siphon. When, however, this automatic valve is opened under the control of the liquid in another chamber or tank of the series, the air-lock of that siphon is weakened to such extent that the liquid in the tank *a* will force that siphon while the other siphons are strengthened and remain sealed. This automatic valve for controlling the air-lock seal pipe of the siphon of one tank by the level of the liquid in another tank

may be constructed in different ways. One form is shown in Figs. 1, 2, 3 and 4, in which f is a casing forming a closed chamber or pocket g about the open end of the seal e, and having an outlet pipe h leading from the bottom of the chamber and opening at a level above the level of the outlet c^3.

i is an air pipe opening into the top of the chamber g and leading from an air bell j in one of the other tanks of the series.

Supposing the chamber or pocket g to be filled with liquid—a condition which occurs as soon as the tank in which it is located is filled with liquid—it will form a seal or liquid valve for the end of the pipe e and strengthen the air-lock of the siphon in the manner described. This condition will continue and the lock of the siphon will remain strengthened until the liquid is discharged from the chamber or pocket g. This will occur when the level of the liquid in that tank, in which the air bell j, which is connected with the pocket g, has attained such height as to produce sufficient air pressure in the pipe i to force the contents of the chamber g out through the outlet h. The valve or seal of the pipe e thus being opened, the air lock in the siphon has become weakened, so that the liquid in the main tank a will force that siphon when the proper level is reached. As the liquid flows out through the chamber c it will pass over the top of the pipe h and refill the pocket g. In applying these devices to control a series of siphons in succession the air bell j of each tank or outlet chamber is connected with the controlling valve or pocket of the siphon which is to operate next, so that on the filling of one tank, the lock of the siphon of the next tank will be weakened in the manner described, and as the filling of any tank or outlet chamber by the discharge through its siphon acts, as has been explained, to fill the pocket of its air lock pipe, it results that the seal of that siphon will be strengthened and will remain strengthened until it is weakened by the opening of the valve upon the refilling of the next tank which precedes it. Thus no matter how many siphons there may be discharging from the common main distributing tank a, all will remain with their seals strengthened except the two which are in operation, the one discharging, by reason of the previous weakening of its seal, acting to weaken the seal of the siphon of the tank next in advance in the series.

Instead of a liquid valve or seal such as that formed by the water in the pocket g, a positive mechanical valve may be used to control the outlet e and the seal of the pipe d. Such a device is shown in Fig. 5. The outlet e is formed in a branch of the pipe d and is controlled by a valve k carried by a pivoted two armed lever m, one arm of which carries a float n and the other arm a float o. The lever and valve are so balanced and arranged, that, when the float n is elevated and the float o is lowered, the valve k will be closed, and vice versa. The float o is an inverted bell and the upturned end of the air pipe j enters it.

The rising of the liquid in the tank or outlet chamber will lift the float n and close the valve k thus strengthening the seal of the air lock pipe d on the siphon. It is necessary, however, that the valve should remain closed, irrespective of the fall of the liquid in the tank or chamber, and therefore the sliding weight w is used. This weight is guided on a rod r carried by the lever m and extending across the fulcrum. When the lever is rocked by the rising of the float n, this weight will slide to the lowered end of the rod r and will act to maintain the lever in this position with the valve k closed irrespective of the level of the liquid. When, however, the tank next in advance has become filled air will be forced through the pipe j into the bell float o and the buoyancy thus produced will rock the lever and open the valve k thus weakening the seal of the siphon. The weight w will slide to the other end of the rod r and maintain the valve k open until the liquid flowing into the tank again lifts the float n and closes it.

The float o is so arranged that its lower edges will always be submerged in the liquid in the tank, the level of which never falls below the outlet c^3 (Fig. 3). After the seal of the pipe is broken and the siphon has discharged, the liquid will flow back into the open end d' of the pipe d and restore the seal. This open end d' is above the outlet e and above the level of the outlet c^3.

s is a relief pipe extending a distance in the long leg of the siphon and leading to an air bell p in the tank a When the level of the liquid in the siphon pipe falls below the end of the pipe s air will rush into the siphon through the bell p and pipe s and break the siphonage.

It is desirable in apparatus of this kind, particularly when applied to the treatment of sewage, that the volume of liquid discharged from the main tank may be controlled at will without interfering with the automatic operation of the discharging siphons in the desired order. For this purpose the bell p is used and is provided with a tube or pipe p' leading into the upper part of the bell and adjustable to raise or lower its open end and thus adjust the level of the inlet to the bell afforded by it. When the level of the liquid in the tank a rises above the open end of the pipe p' air is forced through the pipe s into the siphon b and the air lock thus produced will act to hold back the liquid in the shorter leg and enable a higher level to be attained in the tank a, before the siphon is forced, than would otherwise be possible. This level will depend upon the adjustment of the pipe p' and may be controlled at will. It is important, however, in using such a device that the volume of air introduced in the siphon should not be sufficient to force the strengthened seal of the pipe d, since that would result in starting the siphon before the seal had been weakened by the action of the liquid in the preceding tank. To prevent such forcing of the strengthened seal I employ the surplus air pipe t leading from the pipe d and submerged in the liquid in the tank c to a distance less than the length of the strengthened seal and less than the long leg of the siphon, through which any excess of air introduced by the bell p will find relief before forcing the strengthened or unweakened seal of the pipe d. It is also of importance that the operation of any siphon should be stopped after a certain volume of liquid has been discharged from the tank, *i. e.* after the liquid in the tank has fallen to a certain level. For this purpose I employ a valve s' in the inlet pipe a' controlled by a float t' in the tank a, so that, when the minimum level is reached, the valve will be partially, but not wholly closed. Consequently the supply of liquid will be reduced so as to prevent any ex-

cessive flow which might maintain the level and prolong the siphonic action. Upon the rise of the level the valve is again fully opened. For accomplishing these results, I have shown a slotted link t connecting the float t' and the arm s^2 of the valve.

I do not mean to limit myself to the particular mechanical devices shown for carrying out my invention as the invention includes any means acting during the flow of one siphon to weaken the seal of another siphon in the series and any means for restoring or strengthening the seal of the weakened siphon by the liquid flowing through that siphon.

What I claim and desire to secure by Letters Patent is:—

1. The combination of a liquid tank or reservoir, a series of sealed discharging siphons leading therefrom, and means actuated by the rise of the liquid discharged through one siphon to weaken without breaking the seal of another siphon.

2. The combination of a liquid tank or reservoir, a series of sealed discharging siphons leading therefrom, means actuated by the rise of the liquid discharged through one siphon to weaken without breaking the seal of another siphon, and means to strengthen the seal of each siphon during its own flow controlled by the liquid discharged by such siphon.

3. The combination of a liquid tank or reservoir, a series of sealed discharging siphons leading therefrom, means actuated by the rise of the liquid discharged through one siphon for weakening without breaking the seal of another siphon, and means controlled by the liquid discharged through any siphon for strengthening the seal of that siphon.

4. The combination of a liquid tank or reservoir, a series of sealed discharging siphons leading threfrom, means actuated by the rise of the liquid discharged from one siphon for strengthening the seal of that siphon and weakening without breaking the seal of another siphon.

5. The combination of a liquid tank or reservoir, a series of discharging siphons leading therefrom, a seal pipe from each siphon sealed by the water discharged by its siphon, and means actuated by the rise of the liquid discharged by each siphon to weaken without breaking the seal in the seal pipe of another siphon.

6. The combination of a liquid tank or reservoir, a series of discharging siphons leading therefrom, a seal pipe from each siphon sealed by the water discharged by its siphon, a valve to control the strength of the seal of each seal pipe, and means actuated by the rise of the liquid discharged by one siphon to open the valve in the seal pipe of another siphon and thereby weaken its seal.

7. The combination of a liquid tank or reservoir, a series of discharging siphons leading therefrom, a seal pipe from each siphon sealed by the water discharged by its siphon, a valve to control the strength of the seal of each seal pipe, means controlled by the flow through one siphon to open the valve in the seal pipe of another siphon and thereby weaken its seal, and means controlled by the flow of liquid through each siphon to close the valve of its seal pipe and restore the strengthened seal.

8. The combination of a liquid tank or reservoir, a series of discharging siphons leading therefrom, a seal pipe from each siphon sealed by the water discharged by its siphon, a valve to control the strength of the seal of each seal pipe, and an air bell and pipe controlled by the liquid discharged through one siphon to open the valve in the seal pipe of another siphon and thereby weaken its seal.

9. The combination of a liquid tank or reservoir, a sealed discharging siphon leading therefrom, means to weaken the seal of said siphon, and means controlled by the level of the liquid in the tank or reservoir for forcing air into said siphon.

10. The combination of a liquid tank or reservoir, a sealed discharging siphon leading therefrom, means to weaken the seal of said siphon, means controlled by the level of the liquid in the tank or reservoir for forcing air into said siphon, and regulating devices to control the level at which said means will operate to force air into the siphon.

11. The combination of a liquid tank or reservoir, a sealed discharging siphon leading therefrom, means to weaken the seal of said siphon, and means controlled by the level of the liquid in the tank or reservoir for forcing air into said siphon and a sealed relief pipe from the means for forcing the air having a seal weaker than the unweakened seal of said siphon.

12. The combination of a liquid tank or reservoir, a sealed discharging siphon leading therefrom, means to weaken the seal of said siphon, an air bell in the tank or reservoir, an air pipe from said bell extending into the siphon for forcing air therein, and a sealed relief pipe from the air pipe having a seal weaker than the unweakened seal of the siphon.

13. The combination of a liquid tank or reservoir, a sealed discharging siphon leading therefrom, means to weaken the seal of said siphon, an air bell in the tank or reservoir, a pipe leading from the upper part of said bell having provision for adjusting the height of its open end, and an air pipe leading from said air bell into the discharge leg of the siphon.

14. The combination of a liquid tank or reservoir, a sealed discharging siphon leading therefrom, means to weaken the seal of said siphon, an air bell in the tank or reservoir, a pipe leading from the upper part of said bell having provision for adjusting the height of its open end, an air pipe leading from said air bell into the discharge leg of the siphon, and a relief pipe from said air pipe having a seal weaker than the unweakened seal of the siphon.

15. The combination of a liquid tank or reservoir, a sealed discharge siphon leading therefrom, means to weaken the seal of said siphon, a valve to control the supply of liquid to the tank or reservoir, and means controlled by the level of the liquid in the tank to throttle but not close said valve when the minimum level is reached.

In testimony of which invention, I hereunto set my hand.

ALBERT PRIESTMAN.

Witnesses:

ERNEST HOWARD HUNTER,
R. M. KELLY.