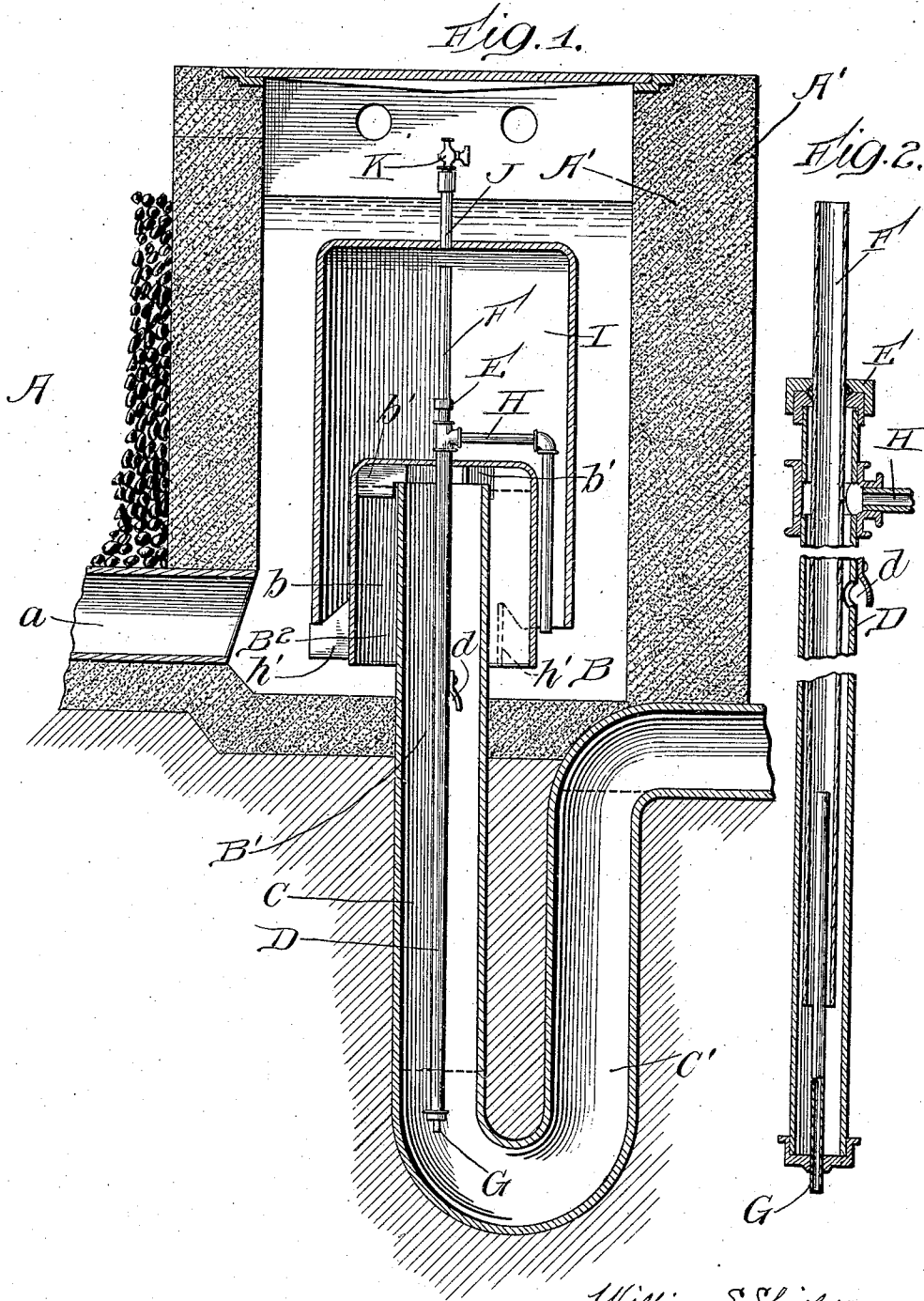


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W. S. SHIELDS.
SIPHON.

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Witnesses:
O. V. Donaghy
James E. Gentry

William S. Shields
Inventor:
by: J. M. Hopkins
attor:

UNITED STATES PATENT OFFICE.

WILLIAM S. SHIELDS, OF CHICAGO, ILLINOIS.

SIPHON.

No. 848,696.

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To all whom it may concern:

Be it known that I, WILLIAM S. SHIELDS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Siphons, of which the following is a specification.

The present invention relates to a siphon for discharging the contents of a tank or other receptacle either into a final discharge-channel or into another tank or receptacle after the liquid has reached a predetermined level in the tank first aforesaid and has stood therein at said level or thereabout for a predetermined length of time. A familiar instance of such a use of a siphon as here referred to is the discharging of the contents of a contact-filter into a filter-bed or the discharging of the contents of one filter-bed into another filter-bed or into a final discharge-channel in a system for the treatment of sewage; but I desire to have it understood that the invention is not limited to siphons used for this particular purpose. On the contrary, it may be embodied in any siphon for automatically discharging the contents of a receptacle after the liquid has reached a given predetermined level therein and has stood at said level or thereabout for a given predetermined length of time. In this respect the present invention is distinguished from that class of siphons, an example of which is shown in my pending application of even date herewith, Serial No. 322,361, in which the siphonic action is started as soon as the liquid to be discharged reaches a predetermined level.

The object of the invention is to provide a siphon of improved construction and, more particularly stated, one in which the period of quiescence is controlled by the escape of a body of air which is put under compression by the rising of liquid within it, means being provided, preferably, for regulating its rate or rapidity of discharge.

To this end the invention consists in the features of novelty that are hereinafter described, with reference to the accompanying drawings, which are made a part hereof, and in which—

Figure 1 is a vertical central section of a siphon embodying the invention and a portion of a receptacle containing the liquid to be discharged. Fig. 2 is an enlarged central section of the vent.

The main receptacle to be emptied is shown at A, A' being an auxiliary receptacle communicating with the main receptacle through a pipe *a* at bottom; but by reason of the free communication between the two receptacles the liquid will stand at the same level in both. In this respect the arrangement shown in the drawings differs from those arrangements found in the prior art, in which mechanism for controlling the period of quiescence is located in any auxiliary receptacle which has no free communication with the main receptacle, save in some instances, where there is a small overflow-pipe leading from the main receptacle into the auxiliary receptacle at about the high level of the liquid in the main receptacle, the period of quiescence being determined by the length of time required to fill the auxiliary receptacle to a given level through said overflow-pipe.

The siphon as a whole is shown at B. It consists of a pipe B', which extends upward into the receptacle for a suitable distance, and an inverted cup or bell B², which is placed over the upper end of the pipe B', so as to leave between the sides of the pipe and the bell an annular space *b*, which constitutes the intake or short leg of the siphon. The pipe B' constitutes the long leg of the siphon and is continued downward to form the down-take-leg C of a deep seal-trap, the uptake-leg C' of which may discharge into any suitable channel.

The structure thus far described as a whole may be regarded as a siphon having a deep seal-trap, the siphon comprising so much of the structure as is above the overflow-level of the trap, while the trap comprises so much of the structure as is below said level. In order to operate in the manner hereinafter described, the "depth of the trap," meaning thereby the distance between its overflow-level and the level of the bottom of the dividing wall or partition between its two legs, must be greater than the maximum head attained by the liquid in the receptacle. It will be understood that in order to prevent the liquid in the receptacle from rising to a higher level any of the known devices, such as a ball-cock, for controlling the supply of liquid to the receptacle will be used.

D is a pipe which passes through the top of the bell B² and is therein permanently secured, so as to be supported thereby, the bell itself being supported by webs *b'*, which rest

upon the top of the long leg of the siphon. The upper end of this pipe carries a stuffing-box E, through which passes a pipe F, both ends of which are open. The stuffing-box forms a liquid and air tight joint around the pipe, but at the same time permits it to be adjusted vertically, so as to bring its lower end to a higher or lower level for a purpose that will appear presently.

10 The lower end of the pipe F terminates at a point between the overflow-level of the siphon-trap and the level of the bottom of the dividing-wall between the two legs of said trap. The lower end of the pipe D is provided with a cap, through which passes a pipe G, the lower end of which is in open communication with the interior of the siphon-trap and the upper end of which is in open communication with the interior of the pipe F, said upper end being at a level above the overflow-level of the siphon-trap. Above this overflow-level the pipe D is provided with an opening *d*, through which the annular space between the pipes D and F has open communication with the long leg of the siphon. At a point between the top of the bell B² and the stuffing-box E one end of a bent pipe H communicates with the annular space between the pipes D and F, whence it proceeds outward over the top of the bell and thence downward to a level above the level of the bottom of the bell, so that its lower end, being open, is in communication with the interior of the receptacle.

35 I is an inverted bell or air-dome of larger capacity than the bell B². The lower portion of the air-dome I surrounds the upper portion of the bell B², their respective diameters being such as to leave between them an annular space through which the liquid may rise and compress the air in the dome. The upper end of the pipe F is in communication with the interior of the dome, so that when the trapped air is released from the siphon in the manner hereinafter described it will be discharged into the dome. The dome has at its top an opening, from which a pipe J extends upward to a level above the maximum level which the liquid in the receptacle attains, and the upper end of this pipe is provided with a petcock K.

It will be seen that the pipe H and so much of the pipe D as is located above the level of the opening *d* constitutes what may appropriately be called a "revent," the only function of which is to insure the return of air into the upper portion of the siphon after the discharging operation is completed. This revent forms no part of the present invention, and so far as the essence of the invention is concerned all of that portion of the pipe D which is located above the opening *d* and which has been denominated the "revent" may be dispensed with. It will be seen also that so much of the pipe D as is located below the

level of the opening *d*, taken in connection with the pipe F, forms a vent for permitting the escape of the trapped air from the siphon and that so much of the pipes D, F, and G as overlap each other form a trap in the vent by which the trapped air is confined in the siphon until the trap is forced, as hereinafter described.

Although the three pipes D, F, and G are located one within another, they are, in fact and in effect, a vent-pipe having a downtake-leg and an uptake-leg, communicating at bottom with each other to form a trap, and a drain-pipe for carrying off the liquid displaced from the uptake-leg of said trap. The annular space between the pipes D and F constitutes the downtake-leg of the vent-trap, while the annular space between the pipes F and G constitutes the uptake-leg of the vent-trap.

While I prefer to use a trapped siphon and a trapped vent constructed as above described, still I desire to have it understood that in its broadest aspect the invention is not limited to the above-described details in the construction of these devices excepting as said details or their equivalents may be necessary to a proper carrying out of the invention.

The operation of the device is as follows: Assuming that the siphon-trap is primed to its overflow-level and that the liquid is standing in the pipes D, F, and G at said level, as the liquid rises in the receptacle it will first seal the lower end of the short leg of the siphon. As it continues to rise the air will be expelled from the short leg of the siphon into the long leg, thence through the opening *d* into the pipe D, and thence through the pipe H into the receptacle until the level of the liquid in the receptacle reaches and seals the lower end of said pipe H. At the same time the lower end of the air-dome I will be sealed. By reason of the liquid seal in the siphon-trap and in the pipes D and F the air will be trapped in the siphon. As the liquid continues to rise in the receptacle it will also rise in the short leg of the siphon and compress the trapped air, and the pressure of this air on the liquid in the downtake-leg of the siphon-trap will tend to force the level of said liquid downward. By reason of the open communication between the siphon and the annular space between the pipes D and F the air will enter said space and exert a downward pressure upon the liquid therein, with a tendency to depress the level thereof; but the tendency to depress the liquid in the downtake-leg of the siphon-trap and vent-trap is resisted by the pressure of the air in the dome I, which pressure is transmitted through the pipe F to the surface of the liquid in the uptake-leg of the vent-trap and through the pipe G to the liquid in the siphon-trap, so that, assuming the pressure on the

air-dome to be equal to that in the siphon, the pressure on all of said liquid-surfaces will be balanced; but the pressure of the air in the dome is constantly and gradually diminishing at a greater or less rate by its escape through the pipe J, and when it is reduced to such an extent that this pressure in the uptake-leg of the vent and in the pipe G is insufficient to counterbalance the pressure from the siphon in the downtake-legs of the vent-trap and siphon-trap the liquid in said legs will be depressed, and when its level reaches the bottom of the legs of the vent-trap the air will pass from the downtake-leg into the uptake-leg and escape into the dome I, thus releasing the trapped air from the siphon and permitting it to be primed and put in operation. The liquid thus displaced from the downtake-leg of the vent-trap flows into the uptake-leg, and the liquid displaced from the uptake-leg flows downward through the drain-pipe and back into the siphon-trap.

It is manifest that by properly adjusting the petcock the period of time required for the necessary reduction of the air-pressure in the dome, and consequently the period of quiescence of the liquid in the receptacle, may be varied. The period of quiescence may be varied by changing the depth of the vent-trap, as hereinbefore described.

What I claim as new, and desire to secure by Letters Patent, is—

1. A time-siphon having a trap, an air-dome in which air is compressed by the rising of liquid within it, said dome having an opening for the escape of air therefrom, and a vent-pipe communicating with the interior of the siphon and with the interior of the dome, said vent-pipe having a trap, the seal of which is forced by the pressure of air in the siphon upon a reduction of the pressure of the air in the dome, substantially as described.

2. A time-siphon having a trap, an air-

dome in which air is compressed by the rising of liquid within it, said dome having an opening for the escape of air and means for regulating the capacity of said opening, and a vent-pipe communicating with the interior of said siphon and with the interior of said dome, said vent-pipe having a trap, the seal of which is forced by the pressure of the air in the siphon upon a reduction of the pressure of the air in the air-dome, substantially as described.

3. A time-siphon having a trap, an air-dome in which air is compressed by the rising of liquid therein, the said dome having an opening for the escape of air therefrom, and a vent-pipe communicating with the interior of said siphon with the interior of said dome, said vent-pipe having a trap and controllable means for adjusting the depth of said trap, substantially as described.

4. The combination, with a receptacle adapted to contain liquid, of a time-siphon, the short leg of which is located in said receptacle, said siphon having a deep seal-trap, an air-dome also located in said receptacle and having an opening for the escape of air, and a vent-pipe having a downtake-leg communicating with the interior of the siphon and an uptake-leg communicating with the interior of the air-dome, said legs being in communication at bottom to form a trap, whereby the pressure of the air in the dome acting upon the liquid in the uptake-leg of the vent-trap will prevent the forcing of said trap by the pressure of the air from the siphon upon the liquid in the downtake-leg of said vent-trap until the pressure of the air within the dome is reduced, substantially as described.

WILLIAM S. SHIELDS.

Witnesses:

L. M. HOPKINS,
JAMES W. COX.